EMERSON
Industrial Automation

User Guide

SM-LON

Unidrive SP
Affinity
Commander SK
Digitax ST

Part Number: 0471-0111-01
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CONTROL TECHNIQUES
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General Information

The manufacturer accepts no liability for any consequences resulting from inappropriate, negligent or incorrect installation or adjustment of the optional operating parameters of the equipment or from mismatching the variable speed drive with the motor.

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Software versions supported by this document

Software	Version
SM-LON Firmware	V01.00.00 or later
Unidrive SP	V01.06.00 or later
Digitax ST	V01.00.00 or later
Affinity	V01.00.00 or later
Commander SK	V01.06.00 or later

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1 Safety Information

1.1 Warnings, cautions and notes

A **Warning** contains information, which is essential for avoiding a safety hazard.

A **Caution** contains information, which is necessary for avoiding a risk of damage to the product or other equipment.

NOTE A **Note** contains information, which helps to ensure correct operation of the product.

1.2 Electrical safety - general warning

The voltages used in the drive can cause severe electrical shock and/or burns, and could be lethal. Extreme care is necessary at all times when working with or adjacent to the drive.

Specific warnings are given at the relevant places in this User Guide.

1.3 System design and safety of personnel

The drive is intended as a component for professional incorporation into complete equipment or a system. If installed incorrectly, the drive may present a safety hazard.

The drive uses high voltages and currents, carries a high level of stored electrical energy, and is used to control equipment which can cause injury.

Close attention is required to the electrical installation and the system design to avoid hazards, either in normal operation or in the event of equipment malfunction. System design, installation, commissioning / start up and maintenance must be carried out by personnel who have the necessary training and experience. They must read this safety information and this User Guide carefully.

The STOP and SECURE DISABLE / SAFE TORQUE OFF functions of the drive do not isolate dangerous voltages from the output of the drive or from any external option unit. The supply must be disconnected by an approved electrical isolation device before gaining access to the electrical connections.

With the sole exception of the SECURE DISABLE / SAFE TORQUE OFF function, none of the drive functions must be used to ensure safety of personnel, i.e. they must not be used for safety-related functions.

The SECURE DISABLE / SAFE TORQUE OFF function is only available as standard on the Unidrive SP / Digitax ST, The Affinity and Commander SK drives do not have a secure disable feature.

The SECURE DISABLE function and secure input on Unidrive SP and the SAFE TORQUE OFF function of the Digitax ST meet the requirements of EN954-1 category 3 for the prevention of unexpected starting of the drive. They may be used in a safety-related application. **The system designer is responsible for ensuring that the complete system is safe and designed correctly according to the relevant safety standards.**

Careful consideration must be given to the functions of the drive which might result in a hazard, either through their intended behaviour or through incorrect operation due to a fault. In any application where a malfunction of the drive or its control system could lead to or allow damage, loss or injury, a risk analysis must be carried out, and where necessary, further measures taken to reduce the risk - for example, an over-speed protection device in case of failure of the speed control, or a fail-safe mechanical brake in case of loss of motor braking.

1.4 Environmental limits

Instructions in the *Unidrive SP User Guide*, *Affinity User Guide* and *Commander SK Getting Started Guide*, *Commander SK Technical Data Guide*, *Digitax ST Getting Started Guide* and *Digitax ST Technical Data Guide* regarding transport, storage, installation and use of the drive must be complied with, including the specified environmental limits. Drives must not be subjected to excessive physical force.

1.5 Compliance with regulations

The installer is responsible for complying with all relevant regulations, such as national wiring regulations, accident prevention regulations and electromagnetic compatibility (EMC) regulations. Particular attention must be given to the cross-sectional areas of conductors, the selection of fuses or other protection, and protective ground connections.

The *Unidrive SP User Guide, Affinity User Guide*, *Commander SK Technical Data Guide* and *Digitax ST Technical Data Guide* contain instructions for achieving compliance with specific EMC standards.

Within the European Union, all machinery in which this product is used must comply with all relevant safety and EMC directives applicable to the installation.

1.6 Motor

Ensure the motor is installed in accordance with the manufacturer's recommendations. Ensure the motor shaft is not exposed.

Standard squirrel cage induction motors are designed for single speed operation. If it is intended to use the capability of the drive to run a motor at speeds above its designed maximum, it is strongly recommended that the manufacturer is consulted first.

Low speeds may cause the motor to overheat because the cooling fan becomes less effective. The motor should be installed with a protection thermistor. If necessary, an electric forced vent fan should be used.

The values of the motor parameters set in the drive affect the protection of the motor. The default values in the drive should not be relied upon.

It is essential that the correct value is entered in the motor rated current parameter, Pr **5.07** (or Pr **0.46** in Unidrive SP, Affinity and Digitax ST, or Pr **0.06** in Commander SK). This affects the thermal protection of the motor.

1.7 Adjusting parameters

Some parameters have a profound effect on the operation of the drive. They must not be altered without careful consideration of the impact on the controlled system. Measures must be taken to prevent unwanted changes due to error or tampering especially if a remote user can access the drive parameters.

1.8 General safety considerations for remote operation

SM-LON enables the possibility of remotely controlling a machine from a distance. It is vital that when connecting to a machine remotely, adequate safety procedures are implemented to prevent damage to the machine or injury to personnel.

Any connection to a “live” system has the possibility of altering the state of the machine, adequate procedures must be implemented to cover this situation.

It is the responsibility of the machine builder to ensure that such a system is safe and complies with current legislation.

2 Introduction

2.1 SM-LON features

The SM-LON is a Solutions Module that can be used on the following products to provide connectivity to a LonWorks® network:

- Unidrive SP
- Affinity
- Commander SK
- Digitax ST

The following list gives an overview of the functionality available within SM-LON.

- Single 3-way 5mm (0.2in) pitch screw terminal pluggable / removable connector
- Supplementary grounding tag
- Support for “Node Object” functional block
- Support for “Variable Speed Motor Drive” (VSD) functional block profile
- “Service pin” operation controlled by parameter
- “Wink” LED
- “Service” LED
- Free topology operation. (78kBit/s, twisted pair, TP/FT-10)
- Automatic setting of reference parameters for network control
- Internal termination resistors selectable by switches

NOTE Although the LonWorks® network specification provides for supplying the DC supply to the device over the network data wires (“Link power”, TP/LP-10), SM-LON does not require this DC supply and will not be affected if this supply is connected.

2.1.1 Unidrive SP: Backup/auxiliary supply

Unidrive SP and Affinity can be connected to a +24Volt backup power supply using the control terminals. This keeps the control electronics and Solutions Module(s) powered up, allowing the SM-LON network to continue communicating when the main AC supply is removed.

2.1.2 What Is LonWorks®?

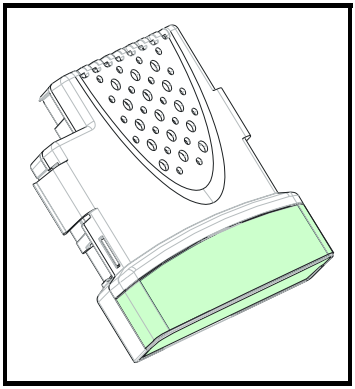
The “LON” in “LonWorks®” is an acronym of **L**ocal **O**perating **N**etwork. Its major application is in building management and HVAC networks.

LonWorks® is intended primarily for distributed applications where there is no master or PLC controlling the network data flow.

Each device on the LonWorks network is linked to other devices using network variables, these network variables can be either input or output variables, the output network variable of one device is linked to the input network variable of another device. Network variable values are updated at pre-set intervals or whenever polled by a device. The network links are configured using a network configuration tool, this configuration tool may then be removed after the network has been configured.

2.2 Solutions Module identification

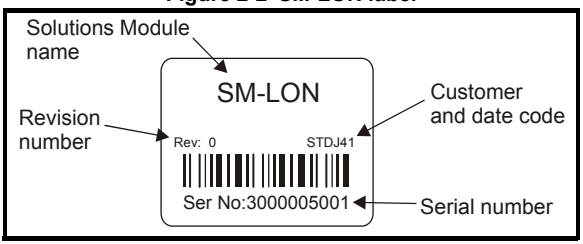
Figure 2-1 SM-LON



The SM-LON can be identified by:

1. The label located on the underside of the Solutions Module.

Figure 2-2 SM-LON label



2. The color coding across the front of the Solutions Module. SM-LON being pale green.

2.2.1 Date code format

The date code is split into two sections: a letter followed by a number (see *Figure 2-2 SM-LON label*).

The letter indicates the year, and the number indicates the week number (within the year) in which the Solutions Module was built.

The letters go in alphabetical order, starting with the letter ‘A’ for 1991 (‘B’ for 1992, ‘C’ for 1993 etc.).

Example:
A date code of Q35 would correspond to week 35 of year 2007.

2.3 Product conformance

SM-LON is a “LonMark® Certified Product” and has been fully tested to conform to the interoperability guidelines from LonMark International.

2.4 Conventions used in this guide

The configuration of the host drive is by means of menus and parameters. A menu is a logical collection of parameters that have similar functionality. The SM-LON module also has parameters but these are mainly for indication only and the configuration is done by the network configuration tool software application.

In the case of a Solutions Module, the parameters will appear in menu 15, 16 or 17 depending on which slot the option module is installed in. The menu is determined by the number before the decimal point.

The method used to determine the menu or parameter is as follows:

- Pr **xx.00** - signifies any menu and parameter number 00.
- Pr **MM.xx** - where **MM** signifies the menu allocated to the solutions module (this could be 15, 16 or 17 on the Unidrive SP and Digitax ST, 15 or 16 on the Affinity drive but will always be 15 on the Commander SK) and **xx** signifies the parameter number.

3 Mechanical Installation

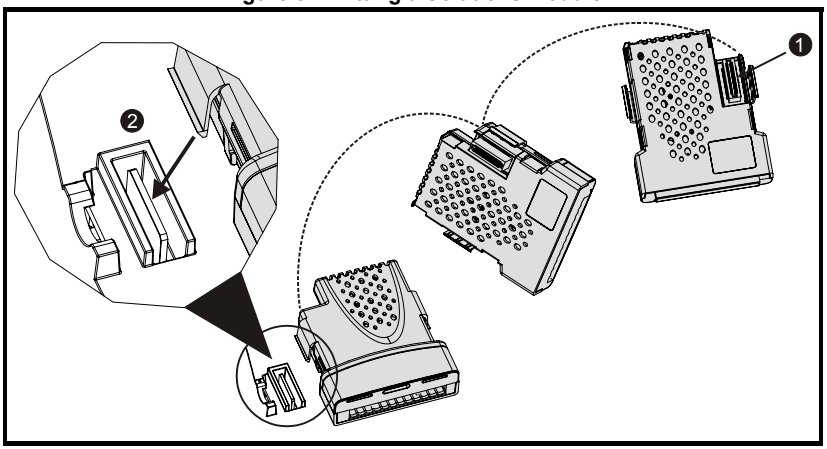
WARNING

Before installing or removing a Solutions Module in any drive, ensure the AC supply has been disconnected for at least 10 minutes and refer to Chapter 1 *Safety Information* on page 5. If using a DC bus supply ensure this is fully discharged before working on any drive or Solutions Module.

3.1 General Installation

The installation of a Solutions Module is illustrated in Figure 3-1.

Figure 3-1 Fitting a Solutions Module



The Solutions Module connector is located on the underside of the module (1). Push this into the Solutions Module slot located on the drive until it clicks into place (2). Note that some drives require a protective tab to be removed from the Solutions Module slot. For further information, refer to the appropriate drive manual.

4 Electrical Installation

4.1 SM-LON module information

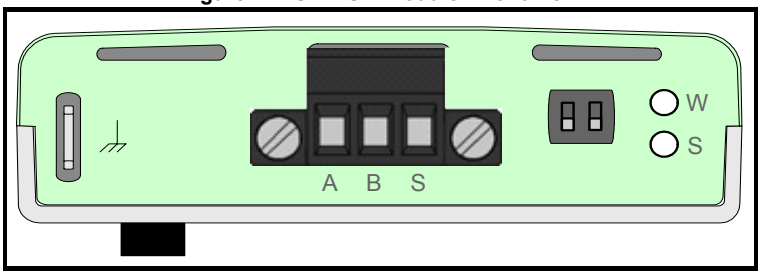
SM-LON provides a single 3-way screw connection to a LonWorks® network. In addition to the 3-way screw connector a grounding tag is supplied for supplementary bonding. The 3-way screw terminals are double insulated to provide electrical isolation from live components in the drive.

SM-LON also provides 2 diagnostic LEDs for status and information purposes. The function of each LED is described in Table 8.1 on page 56.

The network termination resistors are selected by means of two DIP switches, each switch connects a 56 Ω resistor across the network data lines.

The front view of the SM-LON module is shown in Figure 4-1.

Figure 4-1 SM-LON module - front view



The terminal connections, termination resistor selector switches and LED indicators are illustrated in Figure 4-2 .

Figure 4-2 SM-LON module connections and indications

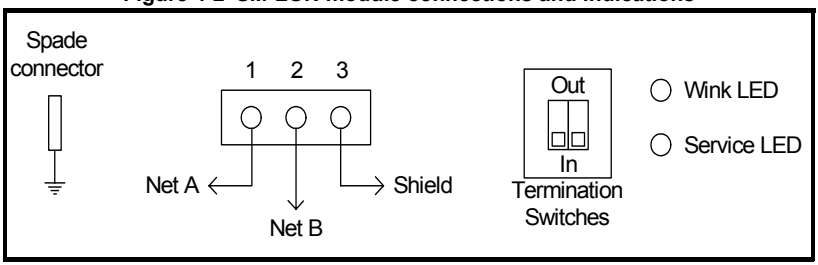


Table 4.1 SM-LON module connector

Terminal	Description
1	Network Data Line A
2	Network Data Line B
3	Shield

4.2 Module grounding

SM-LON is supplied with a grounding tag on the module, this grounding tag **MUST** be connected to the closest possible grounding point using the minimum length of cable. This will greatly improve the noise immunity of the system.

4.3 Network cabling

SM-LON uses a free topology network architecture and supports the TP/FT-10 network topology with a data rate of 78kBit/second. The use of free topology means that the network may consist of bus, ring, or star (wye) connected devices. It is recommended that bus connections are used because of the greater network segment length allowed.

It is recommended that the network cable used should be one listed in Table 4.2. If the cable used is not one of the recommended cables, the network reliability may be compromised and technical support may be limited.

NOTE A good quality installation is vital for a reliable system, cabling issues are the single biggest cause of network down-time. Ensure cabling is correctly routed, wiring is correct and connectors are correctly installed.

Table 4.2 SM-LON recommended cables

Cable Type	AWG	Diameter (mm)	Area (mm^2)
TIA 568A Category 5 cable	24	0.5	0.2
Belden 8471 (PVC jacket) cable	16	1.3	1.3
Belden 85102 (Tefzel jacket) cable	16	1.3	1.3
Level IV cable	22	0.65	0.33
JY (st) 2x2x0.8	20.4	0.8	0.5

4.4 Maximum network length

The main restriction imposed on cabling is the length of a single segment of cable as detailed in Table 4.3. If distances greater than this are required then a router or repeater must be used.

Table 4.3 Maximum network segment lengths

Cable Type (TP/FT-10)	Maximum segment length (metres)	
	Free	Bus
TIA 568A Category 5 cable	450	600
Belden 8471 (PVC jacket) cable	500	2700
Belden 85102 (Tefzel jacket) cable	500	2700
Level IV cable	500	1400
JY (st) 2x2x0.8	500	900

Untwisted wires or cables containing flat or parallel untwisted conductors must not be used on a LonWorks® twisted pair channel. The use of these wires/cables may result in improper network operation and could result in damage to the nodes connected.

4.5 Network termination

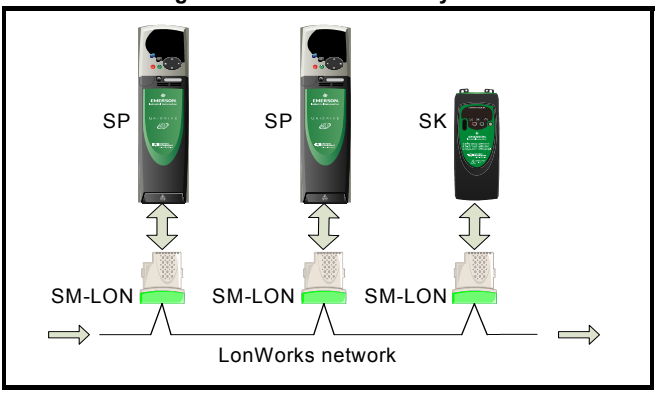
Each segment of the network must be terminated correctly for reliable operation; for a bus connected segment, each end of the segment must be terminated with a 56 Ω resistor; for a free topology segment, the segment needs to be terminated with two 56 Ω resistors, these may be installed at any convenient terminal.

The SM-LON module uses two AC coupled resistors for network termination. The value of each resistor is approximately 56 Ω, selectable by means of the DIP switch. To select a termination resistor the switch should be closed (down), to remove the termination the switch should be opened (up).

4.5.1 Bus topology

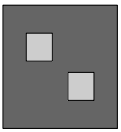
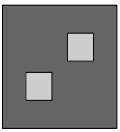
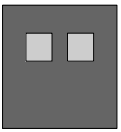
Bus networks use a common backbone to connect all devices. A single cable, the backbone, functions as a shared communication medium that devices attach or tap into. The normal method of connection is illustrated in Figure 4-3, where each cable is terminated at a device and the devices at each end of the segment would each have a 56 Ω termination resistor installed.

Figure 4-3 Bus connected system



Control Techniques recommends that for a bus connected system, the SM-LON module should have one resistor selected if it is the last device on the segment; if it is not the last device on the segment then no resistors should be selected. This is illustrated in Table 4.4.

Table 4.4 SM-LON termination resistor switch configuration (bus)

Switch setting with SM-LON module installed:				
end of segment				**middle of segment**
 W S	Or	 W S		 W S
One 56 Ω resistor selected.		One 56 Ω resistor selected.		No resistors selected

4.5.2 Free topology

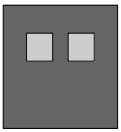
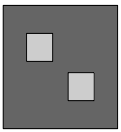
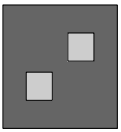
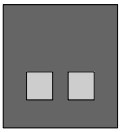
A free topology system has virtually no restrictions on the topology of architecture used. The main types of topology are bus. star (wye), tree and ring; all of these (in any combination) are acceptable methods of connection in a free topology network.

In this type of architecture, the termination resistors may be installed to any single device or any two devices in the segment but there must be a total of two resistors (56 Ω each) installed on each segment.

The SM-LON module is equipped with two resistors (56 Ω each) both of which are individually selectable using the selector switch, this allows the SM-LON module to be the only network device with termination resistors installed.

Table 4.5 illustrates the configuration of the switches for a free topology network.

Table 4.5 SM-LON termination resistor switch configuration (free)

SW1 switch settings			Description
			Both termination resistors not connected. (Installed on other device).
	Or		One 56 Ω resistor connected. (One already installed on another device).
			Two 56 Ω resistors connected. (No others installed on segment).

5 Getting Started

5.1 LonWorks® network overview

To provide interoperability between different manufacturers, the LonWorks® network uses pre-defined functional blocks. Each of these profiles contain a number of input and output network variables and configuration properties. SM-LON supports the Node Object and Variable Speed Motor Drive (VSD) functional block, both of these functional blocks are explained in Chapter 7 *Functional Blocks* on page 36.

There are two types of network variables, these are Standard Network Variable Type (SNVT) and User-defined Network Variable Type (UNVT). The network variables are used to transfer the data between devices, the outputs of a device are connected to the inputs of another device.

The configuration properties are generally set once during commissioning / start up and stored in the device's non-volatile memory. There are also two types of configuration properties, Standard Configuration Property Type (SCPT) and User-defined Configuration Property Type (UCPT).

A LonWorks® network consists of one or more domains, each domain can accommodate up to 255 subnets and each subnet can accommodate up to 127 devices.

5.1.1 Addressing

Each device on a LonWorks® network has two different addresses. The first address is a 48 bit physical address that is fixed in the neuron® IC of the LonWorks® device, this is known as the neuron® ID. The second address consists of the node ID (0 to 127), subnet ID (0 to 255) and the domain ID (0 to 2^{48}-1).

5.1.2 Node ID

Every device on a subnet must have its own unique node identifier. This node identifier can be any whole number in the range 0-127.

5.1.3 Subnets

A subnet is a group of devices connected together and addressed using the same domain and subnet identifiers. The subnet identifier can be any whole number in the range 0-255.

5.1.4 Domains

A domain is a group of devices connected together and addressed using the same domain identifier, either directly or through a repeater, that can communicate with each other. A device can only communicate with another device on the same domain. The domain identifier can be any whole number in the range 0 to 2^{48}-1.

5.2 Minimum software versions required

Table 5.1 lists the minimum versions of drive software for use with SM-LON.

Table 5.1 Required software versions for use with SM-LON

Product	Software Version
SM-LON Firmware	V01.00.00 or later
Unidrive SP	V01.06.00 or later
Digitax ST	V01.00.00 or later
Affinity	V01.00.00 or later
Commander SK	V01.06.00 or later

NOTE It is strongly recommended that the latest firmware is used where possible.

5.3 Setting up the SM-LON module

SM-LON differs from most other fieldbus modules in that most of the network configuration parameters are set using the configuration tool. The only module parameter which may need to be configured on the module during commissioning / start up is the network loss trip parameter (Pr **MM.07**).

5.3.1 Setting the network loss trip

Network loss trip		
Pr **MM.07**	**Default**	0
	Range	0 to 1
	Access	RW

This parameter is used (in conjunction with the received heartbeat time configuration variable - *nciRcvHrtBt*) to cause a trip condition if the network is lost. The value of the variable *nciRcvHrtBt* determines the approximate time (in seconds) that SM-LON will wait, after not receiving any network information, before forcing a network loss trip (Pr **MM.50**=65).

NOTE For a network loss trip to occur, Pr **MM.07** must be set to 1 and the network variable *nciRcvHrtBt* must be set to a value greater than zero.

NOTE The default value for Pr **MM.07** will be 1 for versions of Unidrive SP firmware earlier than V01.12.01

5.3.2 SM-LON diagnostic information

Diagnostic information		
Pr **MM.06**	**Default**	N/A
	Range	-9999 to 9999
	Access	RO

The diagnostic information for the SM-LON can be viewed in the diagnostic information parameter (Pr **MM.06**). When the SM-LON is communicating successfully, Pr **MM.06** will give an indication of the number of network variable updates per second. This includes received messages from other devices and transmitted messages from SM-LON. These messages will generally be network variable updates.

The operating status codes are described in Table 5.2 on page 18.

Table 5.2 SM-LON operating status codes

Pr MM.06	Meaning
	Running states
>0	Indicates the total number of messages SM-LON has detected per second.
0	Module commissioned, but no network messages detected.
-1	The Solutions Module has initialised correctly but has not been commissioned on the network.
-2	Initialisation failure, one possible cause of initialisation failure is the drive is configured in regen mode.
-3	Invalid configuration parameters.
-4	Software error.
-8	The drive interface is being initialised.

5.3.3 SM-LON transmit service pin message

Transmit service pin message		
Pr **MM.36**	**Default**	OFF
	Range	OFF/ON
	Access	RW

This parameter is used to transmit the service pin message to the configuration tool for the purposes of configuring the SM-LON module on the network.

NOTE This parameter reverts to *OFF* after sending the service pin message. The transition from *OFF* to *ON* may not be visible due to the update rate of the display.

5.4 Setting up a LonWorks® network

This section is intended to provide a generic guide for setting up the SM-LON module on a simple LonWorks® network. Due to the many different types and manufacturers of LonWorks® devices, it is not possible to provide detailed information for all devices, the LonPoint™ devices used in this section are manufactured by the Echelon® Corporation.

NOTE Although the Echelon® Corporation is mentioned in this document, this does not represent an endorsement of any particular device or device manufacturer, other devices may be used.

When configuring a LonWorks® network, each device must be configured separately using a network configuration tool such as the LonMaker™ Integration Tool (other configuration tools may also be used).

Before configuring the network devices, it is important to check the network cabling and termination are correct. If the cabling or installation is not correct then the stability and reliability of the network may be compromised.

For further information on network cabling, see section 4.3 *Network cabling* on page 13.

The network may also not operate correctly if a network segment is incorrectly terminated. For further information on network termination, see section 4.5 *Network termination* on page 13.

When all network cabling and termination has been approved and any control wiring (digital or analog inputs or outputs) have been connected according to the relevant connection details supplied with each device, then the devices may be switched on and configured.

5.4.1 Configuring the SM-LON module on the network

In order to configure the SM-LON module on a LonWorks® network, there are several files required by the network integration tool. These files consist of a device interface configuration file (SM-LON.XIF) which defines the SM-LON interface properties for the network integration tool, and various additional resource files which define the functional block profile properties of the SM-LON module.

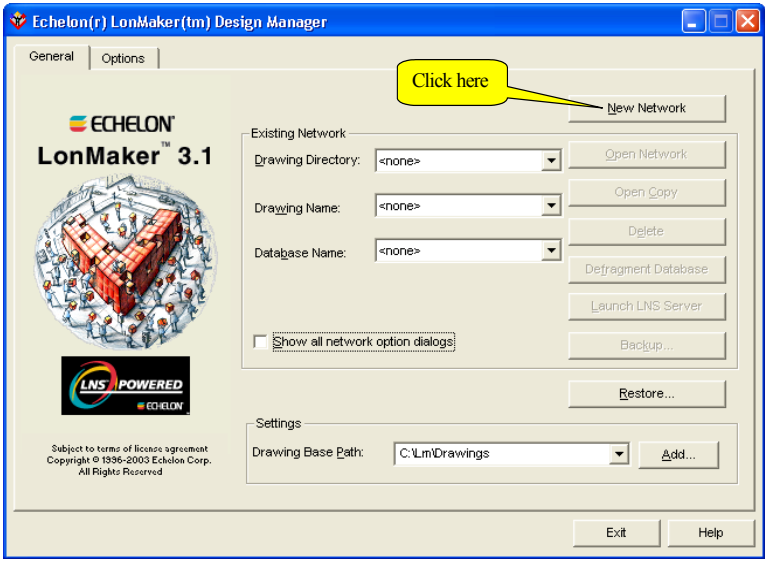
NOTE For more information on the functional blocks supported by SM-LON, see section 7.1 *What is a functional block?* on page 36.

These configuration files are available from your supplier, local drive centre or can be downloaded from the *Control Techniques* website (www.controltechniques.com) and should be placed in the LonWorks® installation folder on the PC (this folder is normally by default "***C:\LonWorks\Types\User\ControlTechniques***") and added to the resource file database using the 'LNS Resource File Catalog Utility'.

Once these files have been added to the database the SM-LON module can be commissioned on the network.

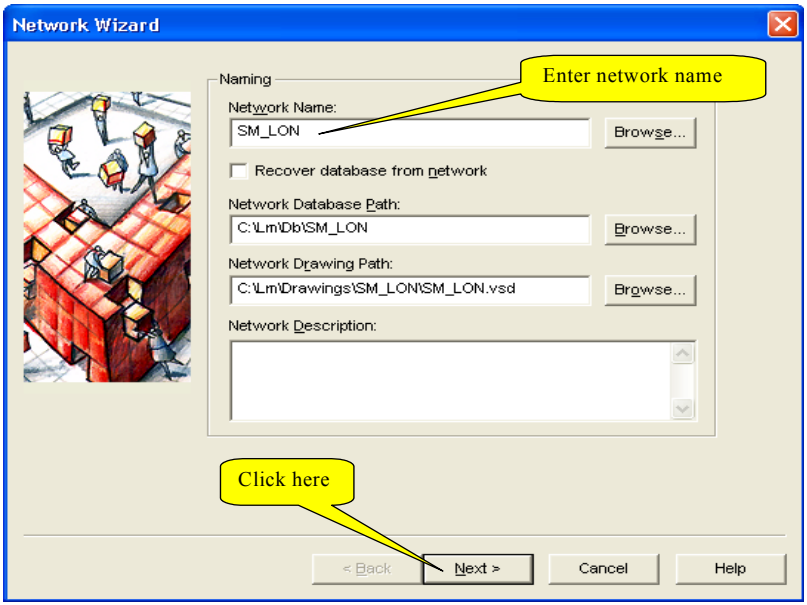
The network configuration tool LonMaker™" is used to configure the SM-LON module on the LonWorks® network, after running the LonMaker™programme, a window similar to the one shown in Figure 5-1 is displayed.

Figure 5-1 Open network manager



Click the '*New Network'* button to create a new network configuration, Microsoft Visio should be launched and the window in Figure 5-2, should be displayed.

Figure 5-2 New network wizard



Enter an appropriate name for the network and click the '*Next*' button.

The window in Figure 5-3 should be displayed, if the network is connected then ensure the checkbox '*Network Attached*' is ticked and click the '*Next*' button, the window shown in Figure 5-4 on page 21 should be displayed.

Figure 5-3 Network attached

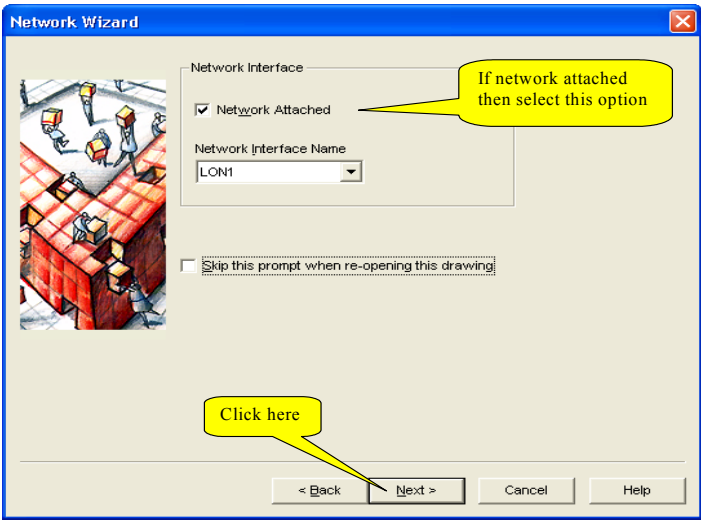
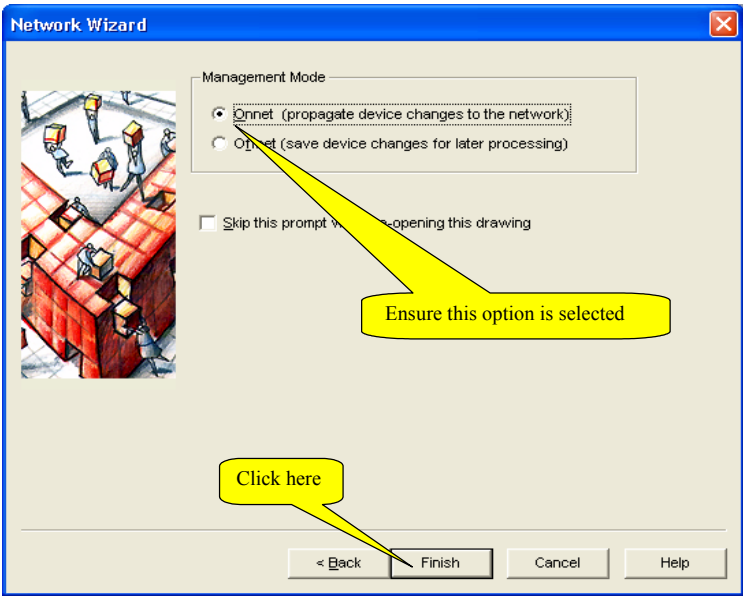
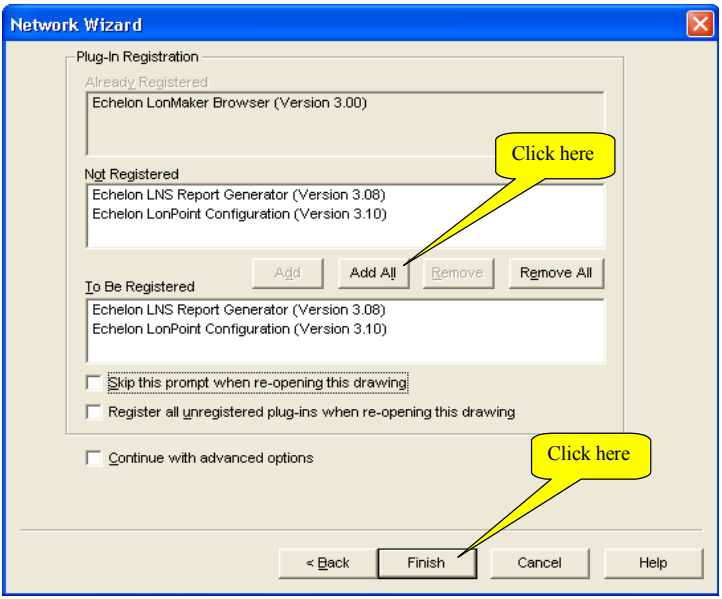


Figure 5-4 Network management mode



Ensure the '*Onnet*' option is selected and click '*Finish*' to continue. The plug-ins then need to be registered by adding all listed plug-ins to the '*To Be Registered*' list as shown in Figure 5-5.

Figure 5-5 Plug-in registration

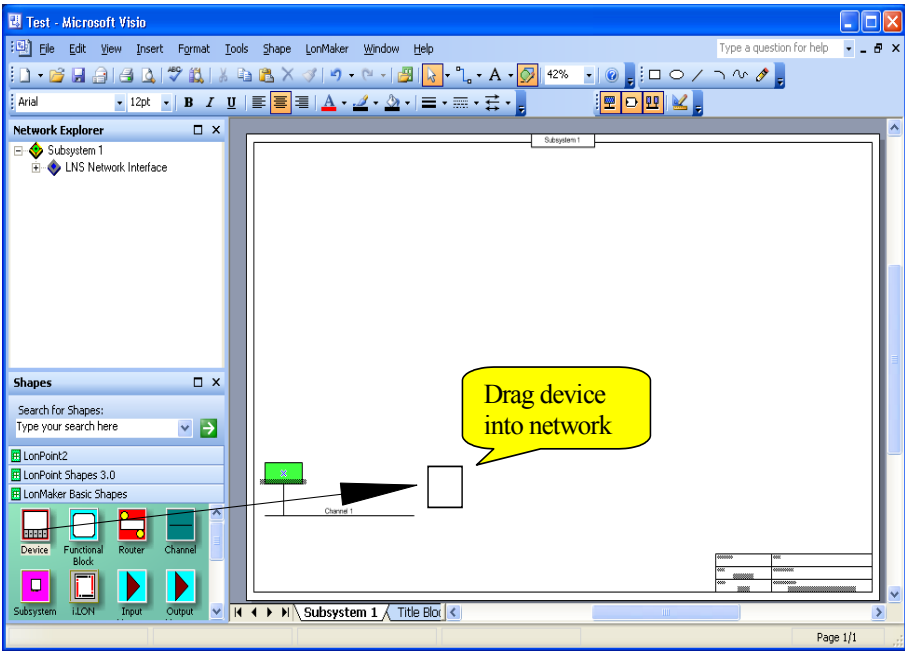


After adding all plug-ins to be registered, click the '*Finish'* button and the LonMaker™ network integration tool will create the network drawing and register all libraries and plug-ins as necessary.

The Visio drawing window will then be displayed and each network device can then be added by selecting the appropriate icon shape and dragging it into the drawing.

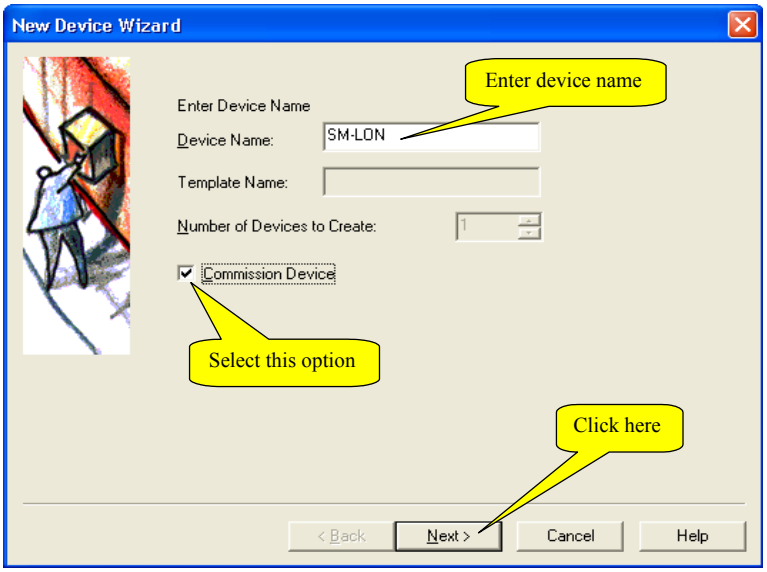
To add the SM-LON module, the standard '*Device*' shape should be used as shown in Figure 5-6.

Figure 5-6 Adding SM-LON device



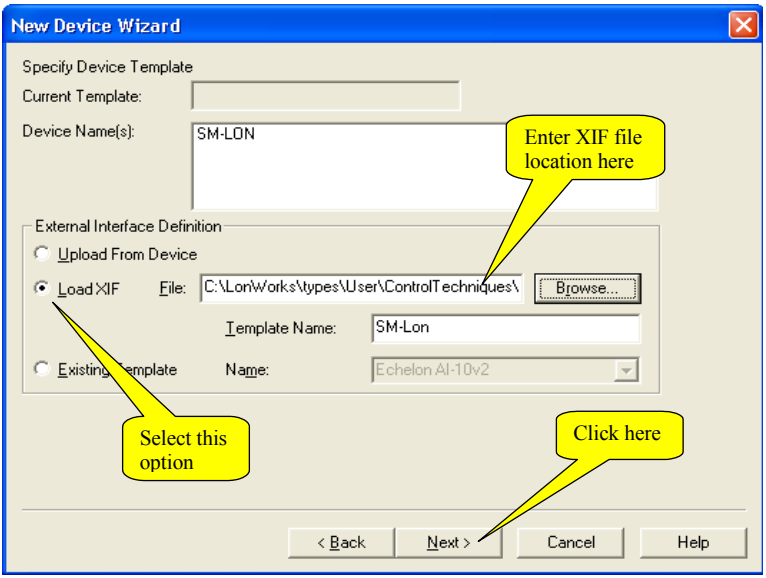
Once placed in the drawing, the '*New Device Wizard'* window is displayed and the required device name should be entered where indicated. If the device is to be commissioned during this procedure then the '*Commission Device*' option should be selected as shown in Figure 5-7 on page 23.

Figure 5-7 New device wizard



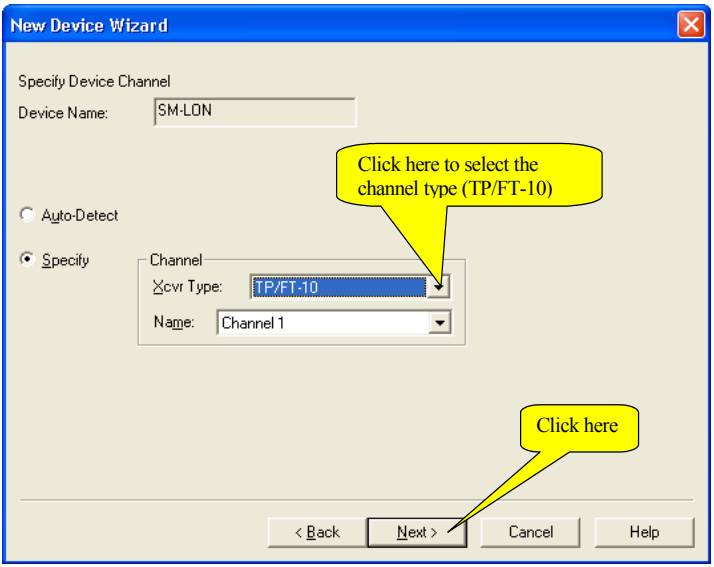
Click the '*Next*' button to continue, a window will prompt you for the location of the XIF (e**X**ternal **I**nterface **F**ile) file as shown in Figure 5-8.

Figure 5-8 XIF file location



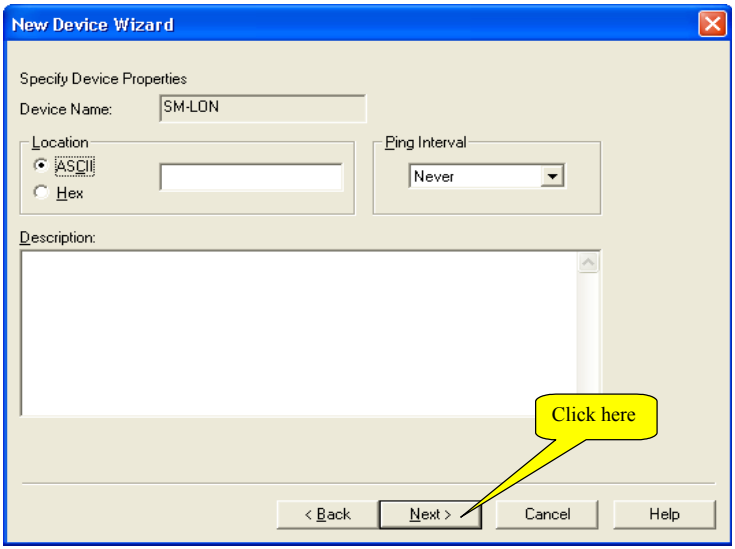
Select the '*Load XIF*' option and enter the location of the appropriate XIF file to be used to interface to the device. This interface file for SM-LON is named '*SM-LON.XIF'* (The location of this file is given at the start of this section). After selecting the XIF file, click the '*Next'* button and the network channel selection will then be displayed as shown in Figure 5-9.

Figure 5-9 Network channel selection



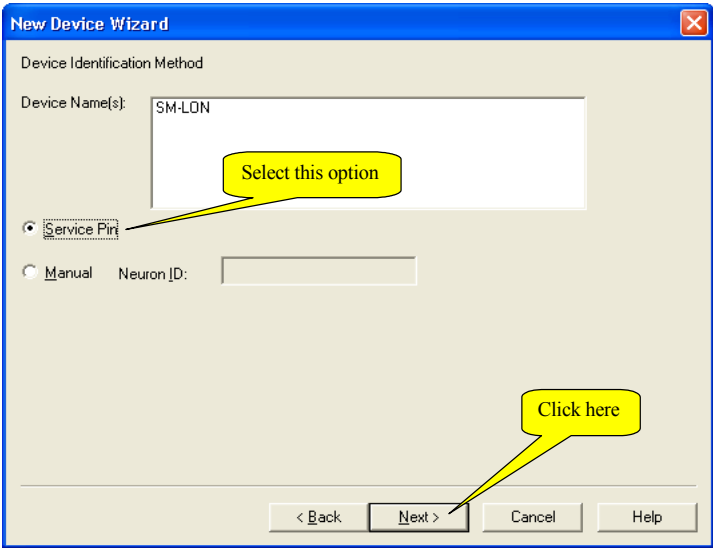
From the drop-down list box select the '*TP/FT-10*' option and click '*Next*' to continue. The window shown in Figure 5-10 is displayed.

Figure 5-10 Device properties



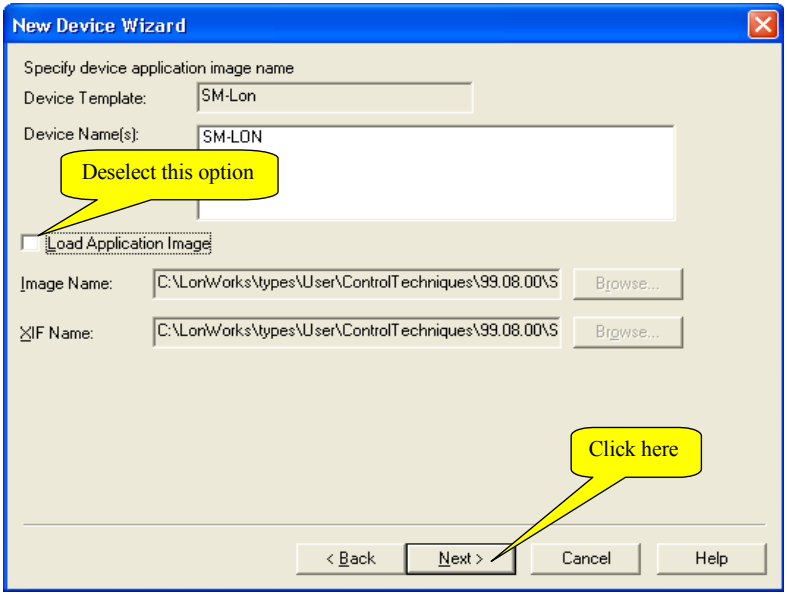
Click '*Next*' to continue and the Device Identification window should be displayed. The '*Service Pin*' option should be selected as shown in Figure 5-11.

Figure 5-11 Device identification



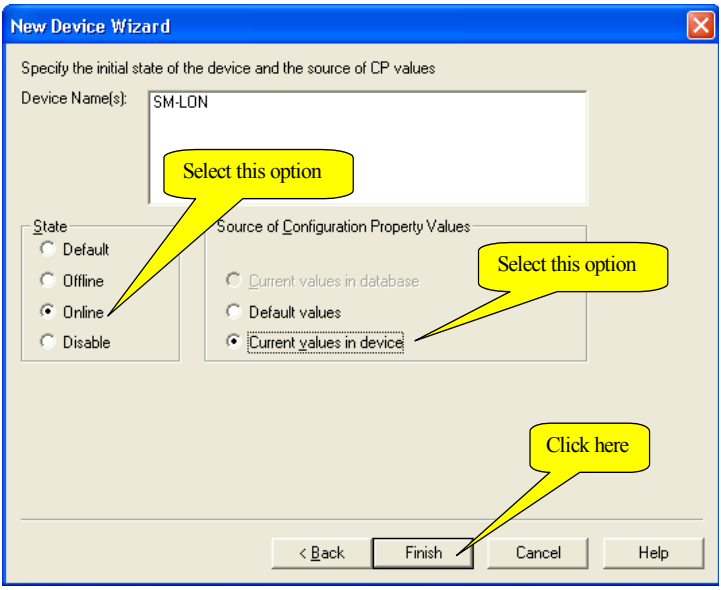
Click the '*Next*' button to continue, the window shown in Figure 5-12 will be displayed.

Figure 5-12 Device image name



Click '*Next*' to continue and the initial device state window is displayed as shown in Figure 5-13.

Figure 5-13 Device state



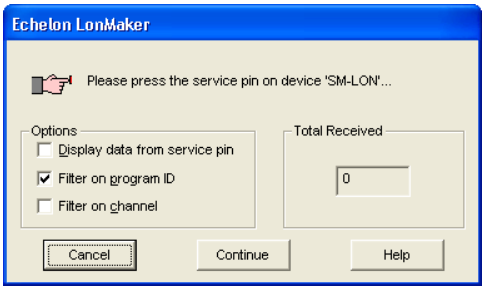
Select the '*Online*' option followed by either '*Default values*' if the default configuration property values are to be used or the '*Current values in device*' option if the configuration property values currently stored in the device are to be used, then click the '*Finish*' button.

The LonMaker™ network integration tool then loads all the files as required and displays a message box prompting for the user to press the service pin on the device as shown in Figure 5-14 on page 27.

The service pin is a button on a device that, when pressed, transmits a message to the LonMaker™ network integration tool to initiate configuration, this message contains the neuron ID of the device and allows the LonMaker™ network integration tool to commission the device. The SM-LON module does not use a button, but a drive parameter (Pr **MM.36**) is provided for this purpose. When this parameter is changed from '*OFF*' (0) to '*ON*' (1), SM-LON will transmit the service message and the "Service message prompt" window will be closed automatically, SM-LON then undergoes a configuration sequence, if this sequence is successful, the SM-LON module will be configured and the "Wink" LED will stop flashing.

NOTE Parameter Pr **MM.36** will automatically revert to '*OFF*' (0) after transmitting the service message.

Figure 5-14 Service message prompt



After the SM-LON module has been configured on the network, the drive must be configured to use the appropriate references. This can be achieved in one of two ways, the first way is to set the parameter Pr **MM.34** to *ON* and save the parameters by setting Pr **xx**.00 to 1000 and resetting the drive. The second way is to use the network variable *nviSetupDrvPars* and set the value of its *State* attribute to 1, this will set all relevant parameters and save the new values.

To run a motor, there are some network variables to be set, first the motor rated speed should be set in *nciNmlSpeed* (RPM) and the motor rated frequency should be set in *nciNmlFreq* (Hz), these should be set as specified on the motor nameplate.

The speed scaling (*nviDrvSpeedScale*) and maximum speed (*nciMaxSpeed*) network variables should both be set to 100.000 (%). The motor speed is now controlled by *nviDrvSpeedStPt*. For more information on using this network variable refer to Table 7.6 on page 44.

5.4.2 Configuring other devices on the network

The process to configure other devices is similar to configuring the SM-LON module; however, for specific details of other devices, the documentation for those devices should be consulted.

NOTE Creating a LonWorks® network using Microsoft Visio and configuring other devices for use on the network is beyond the scope of this document, please refer to the appropriate documentation for additional information.

6 Module Parameters

The basic menu parameters can be accessed through the slot menu in the drive, Pr **MM.xx** where **MM** is the menu for SM-LON in the host drive and **xx** is the parameter number. The basic menu parameters may also be accessed using menu 60, i.e. Pr **60.xx**.

6.1 SM-LON module ID code

SM-LON module ID code		
Pr **MM.01**	**Default**	401 (SM-LON)
	Range	-
	Access	RO

The module ID code indicates the type of module installed in the slot corresponding to menu **MM**. This is useful for checking the module is of the correct type. The ID code for SM-LON is 401.

6.2 SM-LON firmware version

SM-LON firmware - major version (mm.mm)		
Pr **MM.02**	**Default**	N/A
	Range	00.00 to 99.99
	Access	RO

SM-LON firmware - minor version (nn)		
Pr **MM.51**	**Default**	N/A
	Range	0 to 99
	Access	RO

The full version of the SM-LON firmware can be read from the two parameters above. The full version is assembled by combining the major version (mm.mm) and the minor version (nn) as follows: mm.mm.nn.

6.3 SM-LON node ID

SM-LON node ID		
Pr **MM.03**	**Default**	0
	Range	0 to 127
	Access	RO

This is used as a way to identify the node on the network. This parameter is an indication of the value set by the network configuration tool during commissioning / start up, it is not used to actually set the node ID of the drive and can only be changed during the network commissioning / start up process.

6.4 SM-LON diagnostic information

SM-LON diagnostic information		
Pr **MM.06**	**Default**	N/A
	Range	-9999 to 9999
	Access	RO

The diagnostic information for the SM-LON can be viewed in the diagnostic information parameter (Pr **MM.06**). When the SM-LON is communicating successfully, Pr **MM.06** will give an indication of the number of network variable updates per second. This includes received messages from other devices and transmitted messages from SM-LON. These messages will generally be network variable updates.

Table 6.1 SM-LON operating status codes

Pr MM.06	Description
	Running states
>0	Indicates the total number of messages SM-LON has detected per second.
0	Module commissioned, but no network messages detected.
-1	The Solutions Module has initialised correctly but has not been commissioned on the network.
-2	Initialisation failure, one possible cause of initialisation failure is the drive is configured in regen mode.
-3	Invalid configuration parameters.
-4	Software error.
-8	The drive interface is being initialised.

6.5 SM-LON network loss trip

SM-LON network loss trip		
Pr **MM.07**	**Default**	0
	Range	0 to 1
	Access	RW

This parameter is used (in conjunction with the received heartbeat time configuration variable - *nciRcvHrtBt*) to cause a trip condition if the network connection is lost. The value of the variable *nciRcvHrtBt* determines the approximate time (in Seconds) that SM-LON will wait, after not receiving any network information, before forcing a network loss trip (Pr **MM.50**=65).

NOTE For a network loss trip to occur, Pr **MM.07** must be set to 1 and the network variable *nciRcvHrtBt* must be set to a value greater than zero.

NOTE Before the network loss trip is initiated, the motor will be stopped using the speed control configuration properties so the overall trip time may be greater than the setting of the *nciRcvHrtBt* configuration property.

6.6 SM-LON subnet ID

SM-LON subnet ID		
Pr **MM.10**	**Default**	0
	Range	0 to 255
	Access	RO

This is used as a way to identify the subnet on the network. This parameter is an indication of the value set by the network configuration tool during commissioning / start up, it is not used to actually set the subnet ID value and can only be changed during the network commissioning / start up process.

6.7 SM-LON domain ID length

SM-LON domain ID length		
Pr **MM.11**	**Default**	0
	Range	0 to 6
	Access	RO

This is used to indicate the number of bytes within the LonWorks® message which constitute the domain ID number and can only be changed during the network commissioning / start up process.

6.8 SM-LON domain ID byte 1

SM-LON domain ID byte 1		
Pr **MM.12**	**Default**	0
	Range	0 to 255
	Access	RO

This parameter contains the decimal value of the first byte of the network domain ID number to which SM-LON is connected.

6.9 SM-LON domain ID byte 2

SM-LON domain ID byte 2		
Pr **MM.13**	**Default**	0
	Range	0 to 255
	Access	RO

This parameter contains the decimal value of the second byte of the network domain ID number to which SM-LON is connected.

6.10 SM-LON domain ID byte 3

SM-LON domain ID byte 3		
Pr **MM.14**	**Default**	0
	Range	0 to 255
	Access	RO

This parameter contains the decimal value of the third byte of the network domain ID number to which SM-LON is connected.

6.11 SM-LON domain ID byte 4

SM-LON domain ID byte 4		
Pr **MM.15**	**Default**	0
	Range	0 to 255
	Access	RO

This parameter contains the decimal value of the fourth byte of the network domain ID number to which SM-LON is connected.

6.12 SM-LON domain ID byte 5

SM-LON domain ID byte 5		
Pr **MM.16**	**Default**	0
	Range	0 to 255
	Access	RO

This parameter contains the decimal value of the fifth byte of the network domain ID number to which SM-LON is connected.

6.13 SM-LON domain ID byte 6

SM-LON domain ID byte 6		
Pr **MM.17**	**Default**	0
	Range	0 to 255
	Access	RO

This parameter contains the decimal value of the sixth byte of the network domain ID number to which SM-LON is connected.

The domain ID byte parameters are used to indicate the network domain ID number to which SM-LON is connected. These domain parameters indicate the value set by the network configuration tool during commissioning / start up, they are not used to actually set the domain ID value and can only be changed during the network commissioning / start up process.

6.14 SM-LON load defaults

SM-LON load option defaults		
Pr **MM.30**	**Default**	OFF
	Range	OFF/ON
	Access	RW

Pr **MM.30** can be used in conjunction with Pr **MM.39** to default the SM-LON module to factory settings. If Pr **MM.30** is *ON* and the host drive is defaulted, the slot configuration parameters will be over-written using the SM-LON default values.

NOTE If the stored slot configuration parameter values in the drive are for a different type of Solutions Module, the SM-LON will trip “SLx.dF” if installed on a Unidrive SP or Affinity, or “SL.dF” if installed on a Commander SK, but no error code will be set. It will over-write the slot configuration parameter values with the SM-LON default values, but will NOT store these values in the drive, a drive save must be performed to store the values.

The full sequence of events to restore default settings for a SM-LON is as follows:

- Set Pr **MM.30** to *ON*
- **Unidrive SP or Affinity** - Set Pr **MM.00** to 1233 to restore European defaults (1244 for USA defaults). **Commander SK** - Set Pr **00.29** to *EUR* for European defaults (*USA* for American defaults)
- Press the red reset button on the drive
- Network communications will be stopped
- The host drive will load and store its default parameter values
- Default parameter values for the SM-LON will be loaded in Pr **MM.xx** parameters
- The SM-LON default parameter values will be stored in the SM-LON flash memory
- SM-LON will reset and re-initialise using the default values

NOTE The drive settings will also be defaulted with the above procedure.

6.15 SM-LON save option parameters (backup)

SM-LON save option parameters		
Pr **MM.31**	**Default**	OFF
	Range	OFF/ON
	Access	RW

Setting this parameter to *ON* will save the module's current configuration in it's local memory. During this operation network communications will be stopped. This will also save menu 60 (*Pr **60.xx***). This parameter should only be used to transfer a SM-LON module to a different drive.

NOTE A drive save will be required to ensure that SM-LON has the correct settings available from the host drive at startup.

NOTE To save the parameters in the drive, a value of 1000 should be entered in Pr **xx.00** followed by a drive reset (press the reset button, or toggle the reset input, or write the value 100 to Pr **10.38**).

* If the drive is in the under-voltage trip state or is fed from a low voltage backup supply, the value 1001 should be used and not 1000.

6.16 SM-LON re-initialise

SM-LON re-initialise		
Pr **MM.32**	**Default**	OFF
	Range	OFF/ON
	Access	RW

Setting this parameter to *ON* will force the module to re-initialise and start up with the values contained in the slot menu of the host drive (**MM.xx**). This parameter will automatically reset to *OFF* after completion. During this operation network communications will be stopped.

NOTE The transition of **MM.32** from *OFF* to *ON* may not be visible on the drive display due to the update rate of the display.

6.17 SM-LON restore parameters

SM-LON restore parameters		
Pr **MM.33**	**Default**	OFF
	Range	OFF/ON
	Access	RW

Setting this parameter to *ON* will change the operating parameters for the SM-LON module by copying the configuration from the backup copy in the SM-LON module. During this operation network communications will be stopped.

This will not save the current operating menu of the drive (*Pr **MM.xx***), a drive save must be performed to achieve this.

6.18 SM-LON initialise drive reference selectors

SM-LON initialise drive reference selectors		
Pr **MM.34**	**Default**	OFF
	Range	OFF/ON
	Access	RW

This parameter provides an easy method for the user to configure the appropriate drive reference selectors required for correct operation of the LonWorks® VSD functional profile.

The following parameters will be changed:

- Pr **1.10** = 1 (bipolar reference enable)
- Pr **1.14** = 3 (select preset reference specified by #1.15)
- Pr **1.15** = 1 (select preset reference 1 - #1.21)
- Pr **2.02** = 1 (ramp enable)
- Pr **2.10** = 9 (acceleration rate selector)
- Pr **2.20** = 9 (deceleration rate selector)
- Pr **3.13** = 0 (enable frequency slaving)
- Pr **4.11** = 0 (torque mode selector - speed control)
- Pr **6.01** = 1 (stop mode = ramped stop)
- Pr **6.43** = 1 (control word enable)

When all parameters have been set, Pr **MM.34** will revert to *OFF*.

NOTE This parameter performs the same function as the input network variable *nviSetupDrvPars* with the exception that it does not save the parameters, this should be done by the user.

6.19 SM-LON serial number

SM-LON serial number		
Pr **MM.35**	**Default**	N/A
	Range	0 to 9999999
	Access	R

This parameter will display the seven least significant decimal digits of the neuron ID.

The neuron ID is a 48 bit serial number of the LonWorks® transceiver chip in the SM-LON option module. This number is hard-coded into the chip by the manufacturer.

6.20 SM-LON transmit service pin message

SM-LON transmit service pin message		
Pr **MM.36**	**Default**	OFF
	Range	OFF/ON
	Access	RW

This parameter is used to transmit the service pin message to the configuration tool for the purposes of configuring the SM-LON module on the network.

NOTE This parameter reverts to *OFF* after sending the service pin message. The transition from *OFF* to *ON* may not be visible due to the update rate of the display.

6.21 SM-LON wink

SM-LON wink		
Pr **MM.37**	**Default**	OFF
	Range	OFF/ON
	Access	RW

Pr **MM.37** will indicate *ON* if the module has received the LonWorks® “wink” message and will revert to *OFF* when the wink state has been cleared.

Upon receiving the “wink” message, Pr **MM.37** will be set to *ON* and SM-LON will flash the wink LED for a period of approximately 15 seconds.

6.22 SM-LON unconfigure option

SM-LON unconfigure option		
Pr **MM.38**	**Default**	0
	Range	0 to 255
	Access	RW

This parameter can be used to unconfigure the SM-LON module from the network. When Pr **MM.38** changes from 0 to 1, the SM-LON module will remove its network address from the network and the *Service* LED will flash continuously (1 second on, 1 second off). The module can then be re-commissioned using the network configuration tool.

NOTE If Pr **MM.38** is set to a value greater than 0 then SM-LON will write a value of 1 to this parameter.

6.23 SM-LON default configuration property storage

SM-LON default configuration property storage		
Pr **MM.39**	**Default**	0
	Range	0 to 255
	Access	RW

This parameter is used to reset the configuration properties stored within the EEPROM, this will overwrite any configuration property data currently stored in the EEPROM and set them to their default values.

The following sequence can be used to default the configuration property data:

- Set Pr **MM.39** to a value of 55.
- Reset the option module by either setting Pr **xx.00** to a value of 1070 or setting Pr **MM.32** to *ON*.

The configuration properties will be cleared and Pr **MM.39** will be reset to 0..

Care should be taken if using this parameter as the network configuration properties will be changed when the drive is defaulted.

NOTE This parameter is used in conjunction with Pr **MM.30** to restore the factory default settings for the slot configuration parameters and network configuration properties.

6.24 SM-LON option module error status

SM-LON option module error status		
Pr **MM.50**	**Default**	0
	Range	0 to 255
	Access	R

If a serious error occurs, SM-LON will cause the drive to trip on a slot error (SLx.Er for Unidrive SP, Affinity and Digitax ST or SL.Er for Commander SK) and a code relating to the cause of the error will be written to Pr **MM.50**.

Table 6.2 SM-LON error codes

Error Code	Description
0	No fault present.
58	Incorrect non-volatile storage. At least one configuration property was incorrectly formatted or corrupt: Configuration property defaults were loaded.
61	Invalid configuration parameters. This trip will occur if the SM-LON module is installed on a Unidrive SP configured in regen mode.
65	Network loss.
70	No valid fieldbus menu data available in the module to download to the drive. The user has not saved any valid data in the backup flash memory.
74	The option module has overheated.
99	Software fault.

7 Functional Blocks

7.1 What is a functional block?

A functional block represents a collection of network variables and configuration properties on a device that perform a related function. For example, a digital input device with four input switches contains one functional block for each switch.

A functional block is similar in appearance and usage to function blocks used in PLC programming. Each functional block contains a series of variables used as network data links (Network Variables) and another series of variables used to configure the device (Configuration Properties).

7.2 Network variables

Network variables are objects within the functional block and provide the mechanism for devices to send and receive data over the network.

There are two types of network variables, standard network variable (SNVT) and user-defined (UNVT).

Each functional block contains a series of network variables, these variables can be either input or output variables. Input variables names are prefixed "*nvi*" (Network Variable Input) and output variables names are prefixed "*nvo*" (Network Variable Output).

7.3 Configuration properties

Configuration properties are user-configurable values which define the behaviour of a device. They are stored in the non-volatile memory of the device and normally only set once during device commissioning.

There are two types of configuration properties, standard configuration properties (SCPT) and user-defined configuration properties (UCPT).

A functional block may contain one or more of these configuration properties.

7.4 Supported functional blocks

SM-LON supports two functional blocks, these being the Node Object and Variable Speed Motor Drive (VSD).

7.4.1 Node Object functional block

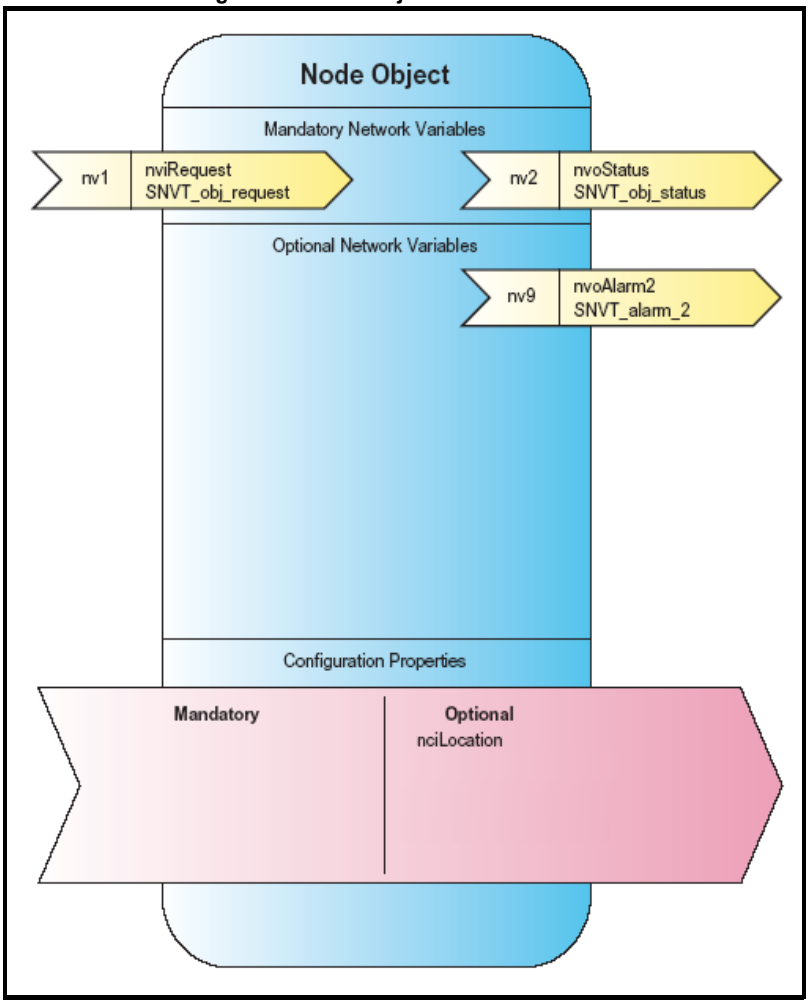
The node object provides basic device management facilities.

SM-LON supports the following node object network variables and configuration properties:

- nviRequest (SNVT) [mandatory]
- nvoStatus (SNVT) [mandatory]
- nvoAlarm2 (SNVT)
- nciLocation (SCPT)

These properties are illustrated in Figure 7-1 on page 37.

Figure 7-1 Node Object Functional Block



The node object network variables consist of one input variable (**nviRequest**), two output variables (**nvoStatus** and **nvoAlarm2**) and one configuration property (**nciLocation**).

Table 7.1 on page 38 describes the **nviRequest** input variable, Table 7.2 on page 39 describes the **nvoStatus** output variable, Table 7.3 on page 40 describes the **nvoAlarm2** output variable and Table 7.4 on page 41 describes the **nciLocation** configuration property.

7.4.2 Node Object Input Network Variable

Table 7.1 nviRequest

nviRequest		Default: N/A
SNVT Type: SNVT_obj_request		Mandatory
Syntax: *Object_ID,Object_Request*		
This input network variable provides the mechanism to request an operation or a mode for a functional block within a device. The request consists of an object identifier (*Object_ID*) followed by an object request code (*Object_Request*). The *Object_ID* is the index number for a functional block on the device. The Node Object functional block index is always zero, the remaining functional blocks are numbered sequentially, starting at one.		
The available values for the *Object_Request* code are as follows:		
RQ_NORMAL (*Object_Request*=0)	This code will return the device to the normal operating state. If the device was disabled then this code will clear the disabled state. If this request is made to the node object, all of the functional blocks (including the node object) will be returned to their normal operating states.	
RQ_DISABLED (*Object_Request*=1)	When this code is applied to the node object, it will be applied to the VSD functional block automatically and the node object output variables will not be propagated to the network (the *nvoStatus* and *nvoAlarm2* variables will not be disabled). When this code is applied to the VSD functional profile, the behaviour will be as follows: If the drive is not currently running, the drive will be inhibited. If the drive is running, the drive will be stopped using the VSD profile parameter settings, when the drive has stopped it will then be inhibited. This will be done using the drive control word (Pr **6.42**). This drive state will be forced and it will prevent the drive from being run over the network. The VSD output variables will also be prevented from being propagated to the network (it will still be possible to poll them).	
RQ_UPDATE_STATUS (*Object_Request*=2)	This code will request the status of the specified functional block to be sent to the **nvoStatus** output network variable. If the node object functional block was specified then the status returned would be the inclusive-OR of both the node object status and the VSD functional block status. (See **nvoStatus** network variable).	
RQ_REPORT_MASK (*Object_Request*=5)	This code will result in a *status mask* value to be sent to the **nvoStatus** output network variable. The *status mask* value shows all of the supported status bits for the specified device. (See **nvoStatus** network variable). If the node object functional block was specified then the *status mask* value returned would be the inclusive-OR of both the node object *status mask* value and the VSD functional block *status mask* value.	
RQ_ENABLE (*Object_Request*=7)	When this command is applied to the node object only the node object network variables will be propagated over the network. When this command is applied to the VSD functional block, the behaviour will be as follows: The LonWorks network variables which run the drive will take effect; SM-LON will stop forcing the drive inhibit if the previous state was ***RQ_DISABLED***. The VSD output network variables that are connected to other devices will be propagated over the network.	
RQ_CLEAR_ALARM (*Object_Request*=10)	This command can be used to clear any drive trip (except hardware fault trips), the network variable **nvoAlarm2** is also cleared if possible. This command is supported by the VSD functional block profile only, if this command is sent to the node object, the *invalid_request* bit will be set in the **nvoStatus** network variable.	

7.4.3 Node Object Output Network Variables

Table 7.2 nvoStatus

nvoStatus	Default: N/A
SNVT Type: SNVT_obj_status	Mandatory
Syntax: *Object_ID,Object_Status*	

This output network variable is used to return a 25 field data string which contains the *Object_ID* in the first data field with the remaining data fields used to indicate the status of the specified object. The significance of each bit in the data string is shown below.
If the ***RQ_REPORT_MASK*** command is used in the **nviRequest** node object network variable then **nvoStatus** will return a *status mask* value which indicates the supported status bits of the specified functional block.
If the node object is specified in the ***RQ_REPORT_MASK*** command then **nvoStatus** will return a *status mask* value which would be the inclusive-OR of both the node object *status mask* value and the VSD functional block *status mask* value.

The *Object_ID* is the index number for a functional block on the device. The Node Object functional block index is always zero, the remaining functional blocks are numbered sequentially, starting at one.

The *Object_Status* fields are decoded as follows:

Field	Size	Name	Supported by SM-LON
24	Byte	*Object_ID*	Yes
23 (MSB)	Bit	*invalid_id*	Yes
22	Bit	*invalid_request*	Yes
21	Bit	*disabled*	Yes
20	Bit	*out_of_limits*	No
19	Bit	*open_circuit*	No
18	Bit	*out_of_service*	No
17	Bit	*mechanical_fault*	No
16	Bit	*feedback_failure*	No
15	Bit	*over_range*	No
14	Bit	*under_range*	No
13	Bit	*electrical_fault*	No
12	Bit	*unable_to_measure*	No
11	Bit	*comm_failure*	No
10	Bit	*fail_self_test*	No
9	Bit	*self_test_in_progress*	No
8	Bit	*locked_out*	No
7	Bit	*manual_control*	No
6	Bit	*in_alarm*	Yes
5	Bit	*in_override*	No
4	Bit	*report_mask*	Yes
3	Bit	*programming_mode*	No
2	Bit	*programming_fail*	No
1	Bit	*alarm_notify_disabled*	No
0 (LSB)	Bit	*reset_complete*	No

NOTE The *invalid_id* and *invalid_request* bits will not be reported as being supported when the ***RQ_REPORT_MASK*** command is used in the **nviRequest** enquiry, this is because they are mandatory features and their support is presumed.

The *in_alarm* bit will be set if there is an active alarm set in the network variable **nvoAlarm2** (i.e. when the drive is tripped or has an alarm condition set).

The *disabled* bit will be set when the functional block from which the status is being read is disabled.

Table 7.3 nvoAlarm2

nvoAlarm2		Default: N/A
SNVT Type: SNVT_alarm_2		Optional
Syntax: *Alarm_Type,Priority,Time,Sequence, Description*		
This variable returns information relating to the drive's trip or alarm state (if one exists).		
Alarm_Type	Length: 1 byte	
AL_NO_CONDITION (*Alarm_Type=0)*	This code will be used if no drive alarm or trip condition exists.	
AL_FATAL_ERROR (*Alarm_Type=30)*	This code will be used for all hardware fault trips on the drive. E.g. SLx.HF for Unidrive SP and SL.HF or HF.xx for Commander SK.	
AL_ERROR (*Alarm_Type=31)*	With the exception of the hardware fault trips, this code will be used for all other drive trips.	
AL_WARNING (*Alarm_Type=32)*	This code will be used for all drive alarm conditions. E.g. "br.rS", "Hot" and "OVLd".	
Priority	Length: 1 byte	
(*Priority=255)*	This will be set to a value of zero.	
Time	Length: 6 bytes	
(*byte1=0)*	This will be set to a value of zero.	
(*byte2=0)*	This will be set to a value of zero.	
(*byte3=0)*	This will be set to a value of zero.	
(*byte4=0)*	This will be set to a value of zero.	
(*byte5=0)*	This will be set to a value of zero.	
(*byte6=0)*	This will be set to a value of zero.	
Sequence	Length: 1 byte	
	This will be incremented by one for each **nvoAlarm2** update and will wrap around to zero after 255.	

nvoAlarm2		Default: N/A
SNVT Type: SNVT_alarm_2		Optional
Syntax: *Alarm_Type,Priority,Time,Sequence, Description*		
Description	Length: 22 bytes	
	These bytes are ASCII coded string characters and will contain the trip code as defined in the relevant drive user guide or, in the case of an alarm condition, the alarm message. If no alarm or trip condition is present, the values read back in the first seven bytes will be 78,111,32,84,114,105,112 (the remaining bytes will all be set to zero values); this decodes as the message “No Trip”. If a trip condition is present then the values returned will be 84,114,105,112,32 (“Trip “) followed by the drive trip code. For example, if an output current overload trip was present (It.AC - trip code 20), the following values will be returned: 84,114,105,112,32,50,48; this decodes as “Trip 20”. If an alarm condition is present, an appropriate message will be returned. Drive trip messages will take priority over any alarm condition currently present.	

7.4.4 Node Object Input Configuration Property

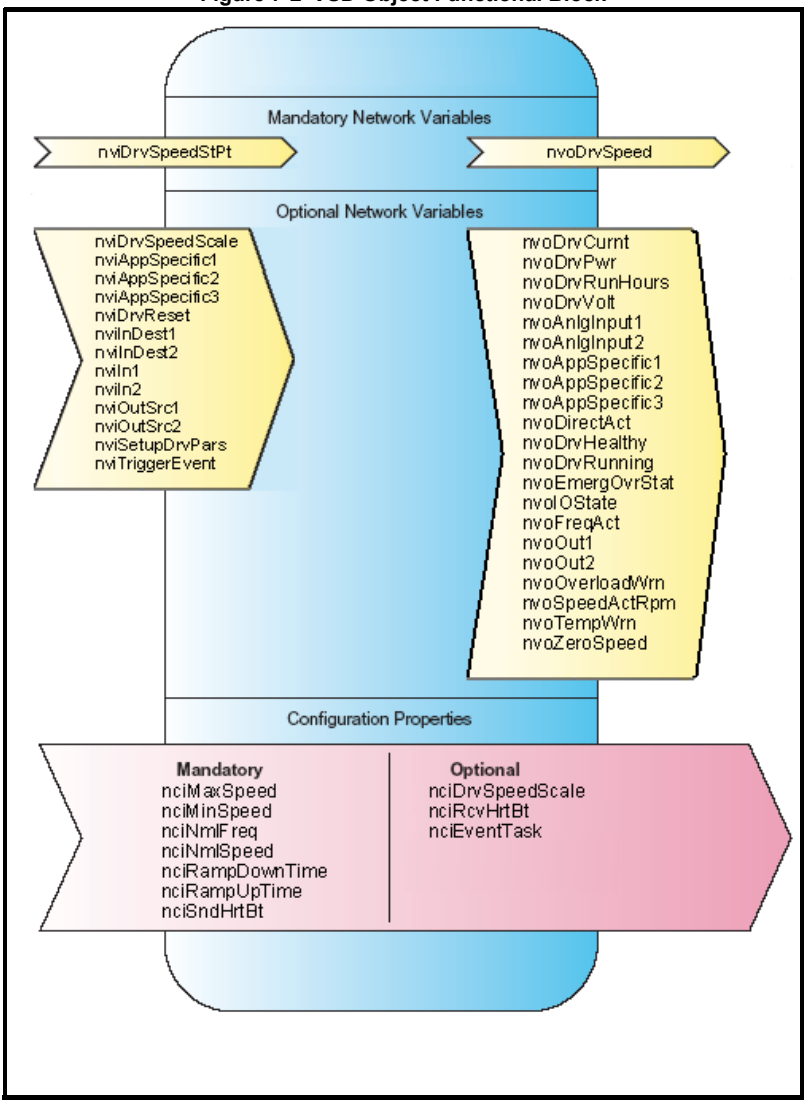
Table 7.4 nciLocation

nciLocation	Default: N/A
SNVT Type: SCPTlocation	Optional
Syntax: *Location*	
This configuration property is a string value intended to contain the location of the LonWorks® device. It may be set by the user during the network configuration or left blank as required, it will have no effect on the device functionality.	

7.4.5 Variable Speed Motor Drive (VSD) object functional block

The variable speed motor drive object provides basic drive control. The network variables and configuration properties are shown in Figure 7-2.

Figure 7-2 VSD Object Functional Block



SM-LON supports the two mandatory network variables *nviDrvSpeedStPt* and *nvoDrvSpeed* along with thirty four optional network variables and ten configuration properties. These network variables and configuration properties are listed in Section 7.4.6 and Section 7.4.7 on page 43.

7.4.6 Standard VSD network variables and configuration properties

- nviDrvSpeedScale (SNVT)
- nviDrvSpeedStPt (SNVT) [mandatory]
- nvoDrvCurnt (SNVT)
- nvoDrvPwr (SNVT)
- nvoDrvRunHours (SNVT)
- nvoDrvSpeed (SNVT) [mandatory]
- nvoDrvVolt (SNVT)
- nciDrvSpeedScale (SCPT)
- nciMaxSpeed (SCPT) [mandatory]
- nciMinSpeed (SCPT) [mandatory]
- nciNmlFreq (SCPT) [mandatory]
- nciNmlSpeed (SCPT) [mandatory]
- nciRampDownTime (SCPT) [mandatory]
- nciRampUpTime (SCPT) [mandatory]
- nciRcvHrtBt (SCPT)
- nciSndHrtBt (SCPT) [mandatory]

7.4.7 Control Techniques specific VSD network variables and configuration properties

In addition to the standard network variables and configuration properties, the following Control Techniques specific variables and properties are available in the VSD functional block.

- nviAppSpecific1 (SNVT)
- nviAppSpecific2 (SNVT)
- nviAppSpecific3 (SNVT)
- nviDrvReset (SNVT)
- nviInDest1 (SNVT)
- nviInDest2 (SNVT)
- nviIn1 (UNVT)
- nviIn2 (UNVT)
- nviOutSrc1 (SNVT)
- nviOutSrc2 (SNVT)
- nviSetupDrvPars (SNVT)
- nviTriggerEvent (SNVT)
- nvoAnlgInput1 (SNVT)
- nvoAnlgInput2 (SNVT)
- nvoAppSpecific1 (SNVT)
- nvoAppSpecific2 (SNVT)
- nvoAppSpecific3 (SNVT)
- nvoDirectionAct (SNVT)
- nvoDrvHealthy (SNVT)
- nvoDrvRunning (SNVT)

- nvoEmergOvrStat (SNVT)
- nvoFreqAct (SNVT)
- nvoIOState (SNVT)
- nvoOut1 (UNVT)
- nvoOut2 (UNVT)
- nvoOverloadWrn (SNVT)
- nvoSpeedActRpm (SNVT)
- nvoTempWrn (SNVT)
- nvoZeroSpeed (SNVT)
- nciEventTask (UCPT)

The VSD functional block network variables consist of fourteen input variables, twenty-three output variables and ten configuration properties, these are described below:

7.4.8 VSD Functional Block Standard Input Network Variables

Table 7.5 nviDrvSpeedScale

nviDrvSpeedScale	Default: See **nciDrvSpeedScale**
SNVT Type: SNVT_lev_percent	Optional
Syntax: *Value*	Range: -163.84% to 163.83%
This input network variable provides the scaling factor which is applied to the value of the **nviDrvSpeedStPt** speed reference before it is converted to RPM.	

Table 7.6 nviDrvSpeedStPt

nviDrvSpeedStPt	Default: N/A
SNVT Type: SNVT_switch	Mandatory
Syntax: *Value*,*State*	Range: 0 to 100.0, 0 to 1
This input network variable provides two settings, the first setting (*Value*) is the speed setpoint which can be in the range 0 to 100% of the setting of **nciNmlSpeed**. The second setting (*State*) is used to start and stop the drive.	
State=0	The drive will decelerate to zero speed using the **nciRampDownTime** configuration property value. Sets bit 5 (Run) of the drive control word (Pr **6.42**) to 0.
State=1	The drive will accelerate to the specified speed (*Value*) using the **nciRampUpTime** configuration property value. Sets bit 5 (Run) of the drive control word (Pr **6.42**) to 1.

7.4.9 VSD Functional Block Standard Output Network Variables

Table 7.7 nvoDrvCurnt

nvoDrvCurnt	Default: N/A
SNVT Type: SNVT_amp	Optional
Syntax: *Value*	Range: 0 to 3276.6 A
This output network variable provides an indication of the drive output current in 0.1A units. This value is taken from Pr **4.01**	

Table 7.8 nvoDrvPwr

nvoDrvPwr	Default: N/A
SNVT Type: SNVT_power_kilo	Optional
Syntax: *Value*	Range: 0 to 6553.4 kW
This output network variable provides an indication of the drive output power in 0.1kW units. This value is taken from Pr **5.03**	

Table 7.9 nvoDrvRunHours

nvoDrvRunHours	Default: N/A
SNVT Type: SNVT_time_hour	Optional
Syntax: *Value*	Range: 0 to 65534 Hours
This output network variable provides an indication of the total drive running duration in hours. This value is taken from Pr **6.22** and Pr **6.23** and converted into hours.	

Table 7.10 nvoDriveSpeed

nvoDriveSpeed	Default: N/A
SNVT Type: SNVT_lev_percent	Mandatory
Syntax: *Value*	Range: -163.84% to 163.83%
This output network variable provides an indication of the drive speed feedback. This value is calculated from Pr **5.03** for open loop mode or from Pr **3.02** if the drive is in either closed loop or servo mode. The relevant parameter value is converted into a percentage of the nominal motor speed as specified in the **nciNmlSpeed** configuration property.	

Table 7.11 nvoDrvVolt

nvoDrvVolt	Default: N/A
SNVT Type: SNVT_volt	Optional
Syntax: *Value*	Range: 0 to 3276.6 V
This output network variable provides an indication of the drive output voltage in 0.1V units. This value is taken from Pr **5.02**	

7.4.10 VSD Functional Block Standard Configuration Properties

Table 7.12 nciDrvSpeedScale

nciDrvSpeedScale	Default: 0%
SNVT Type: SNVT_lev_percent	Optional
Syntax: *Value*	Range: -163.840% to 163.830%
This configuration property provides the default value for the **nviDrvSpeedScale** input network variable. This is provided in the event of the network variable not being connected to an appropriate device output. This value will also be used to update **nviDrvSpeedScale** if it is has not been updated for a period longer than the received heartbeat time **nciRcvHrtBt**.	

Table 7.13 nciMaxSpeed

nciMaxSpeed	Default: 100.000%
SNVT Type: SNVT_lev_percent	Mandatory
Syntax: *Value*	Range: -163.840% to 163.830%
This configuration property is used to limit the maximum speed reference. This value is applied to the speed reference **nviDrvSpeedStPt** after it has been scaled by the speed scaling network variable **nviDrvSpeedScale** but before it is converted to RPM.	

Table 7.14 nciMinSpeed

nciMinSpeed	Default: 0%
SNVT Type: SNVT_lev_percent	Mandatory
Syntax: *Value*	Range: -163.840% to 163.830%
This configuration property is used to limit the minimum speed reference. This value is applied to the speed reference **nviDrvSpeedStPt** after it has been scaled by the speed scaling network variable **nviDrvSpeedScale** but before it is converted to RPM.	

Table 7.15 nciNmlFreq

nciNmlFreq	Default: 50 or 60 Hz
SNVT Type: SNVT_freq_hz	Mandatory
Syntax: *Value*	Range:0 to 100 Hz
This configuration property is used to limit the motor rated frequency. In open and closed loop modes this value will be mapped to Pr **5.06**, in servo mode it will not be mapped to any parameter and will have no effect on the drive.	

Table 7.16 nciNmlSpeed

nciNmlSpeed	Default: 1800 RPM
SNVT Type: SNVT_rpm	Mandatory
Syntax: *Value*	Range: 0 to 65534 RPM
This configuration property is used to convert the speed command percentage value of the input network variable **nviDrvSpeedStPt** and the network output variable **nvoDriveSpeed** into RPM.	

Table 7.17 nciRampDownTime

nciRampDownTime	Default: 10.0 seconds
SNVT Type: SNVT_time_sec	Mandatory
Syntax: *Value*	Range: 0.0 to 6553.4 seconds
This configuration property is used to specify the time (in seconds) that the drive will take to decelerate the motor from the maximum speed (**nciNmlSpeed**) to the zero speed. This value will be scaled to the time (in seconds) that the drive will take to decelerate by 1000 RPM (or 100 Hz in open loop mode). This scaled value will be written to Pr **2.21**. The ramps must be enabled for this configuration property to have any effect.	

Table 7.18 nciRampUpTime

nciRampUpTime	Default: 10.0 seconds
SNVT Type: SNVT_time_sec	Mandatory
Syntax: *Value*	Range: 0.0 to 6553.4 seconds
This configuration property is used to specify the time (in seconds) that the drive will take to accelerate the motor from zero speed to the maximum speed (**nciNmlSpeed**). This value will be scaled to the time (in seconds) that the drive will take to accelerate by 1000 RPM (or 100 Hz in open loop mode). This scaled value will be written to Pr **2.11**. The ramps must be enabled for this configuration property to have any effect.	

Table 7.19 nciRcvHrtBt

nciRcvHrtBt	Default: 0.0 seconds
SNVT Type: SNVT_time_sec	Optional
Syntax: *Value*	Range: 0.0 to 6553.4 seconds
This configuration property is used to specify the maximum time interval allowed between updates of the input network variables **nviDrvSpeedStPt** and **nviDrvSpeedScale**. If the specified time is exceeded for either variable (and this feature is enabled on the device) the following events will be occur. 1. The drive will decelerate to zero speed using the ramp configuration properties and then it will be inhibited. 2. The value of the input network variable that was not updated will be set to its default value. 3. If both variables were not updated and Pr **MM.07** is set to 1 then SM-LON will initiate a network loss trip on the drive. If this configuration property is set to 0.0 then the heartbeat function is disabled and consequently the network loss detection is also disabled.	

Table 7.20 nciSndHrtBt

nciSndHrtBt	Default: 0.0 seconds
SNVT Type: SNVT_time_sec	Mandatory
Syntax: *Value*	Range: 0.0 to 6553.4 seconds
This configuration property is used to specify the time interval between updates of the output network variables **nvoDrvCurnt**, **nvoDriveSpeed**, **nvoDrvVolt** and **nvoDrvPwr**. There will be one instance of this property to control the transmission interval of all the output variables. If this configuration property is set to 0.0 then no updates of these output variables will be propagated over the network.	

7.4.11 VSD Functional Block CT Specific Input Network Variables

Table 7.21 nviAppSpecific1

nviAppSpecific1	Default: 0
SNVT Type: SNVT_count_inc	Optional
Syntax: *Value*	Range: -32768 to 32767
This input network variable will map directly to Pr **18.13** and provides a means of writing a value to the drive. This network variable is better suited for run-time usage than the configurable parameter input variables **nviIn1** or **nviIn2**.	

Table 7.22 nviAppSpecific2

nviAppSpecific2	Default: 0
SNVT Type: SNVT_count_inc	Optional
Syntax: *Value*	Range: -32768 to 32767
This input network variable will map directly to Pr **18.14** and provides a means of writing a value to the drive. Due to fewer internal resources being used, this network variable is better suited for run-time usage than the configurable parameter input variables **nviIn1** or **nviIn2**.	

Table 7.23 nviAppSpecific3

nviAppSpecific3	Default: 0
SNVT Type: SNVT_count_inc	Optional
Syntax: *Value*	Range: -32768 to 32767
This input network variable will map directly to Pr **18.15** and provides a means of writing a value to the drive. Due to fewer internal resources being used, this network variable is better suited for run-time usage than the configurable parameter input variables **nviIn1** or **nviIn2**.	

Table 7.24 nviDrvReset

nviDrvReset	Default: 0.0, 0
SNVT Type: SNVT_switch	Optional
Syntax: *Value*,*State*	Range: 0 to 100.0, 0 to 1
This input network variable provides two settings, the first setting (*Value*) will be ignored by SM-LON. The second setting (*State*) is used to reset the drive; a transition from 0 to 1 will trigger a drive reset using Pr **10.38**.	

Table 7.25 nviInDest1

nviInDest1	Default: 1821
SNVT Type: SNVT_count	Optional
Syntax: *Value*	Range: 0 to 65535
This input network variable is used to specify a drive parameter to be used as a destination parameter for the input network variable **nviIn1**. The value in this network variable should be the drive menu number multiplied by 100 plus the parameter number; e.g. to use Pr **18.30** as the destination parameter, this network variable should be set to a value of 1830; the value of the input network variable **nviIn1** will then be written to Pr **18.30**. Note: Care must be taken when selecting the destination parameter to ensure that the full input value of **nviIn1** can be written correctly.	

Table 7.26 nviInDest2

nviInDest2	Default: 1822
SNVT Type: SNVT_count	Optional
Syntax: *Value*	Range: 0 to 65535
This input network variable is used to specify a drive parameter to be used as a destination parameter for the input network variable **nviIn2**. The value in this network variable should be the drive menu number multiplied by 100 plus the parameter number; e.g. to use Pr **18.30** as the destination parameter, this network variable should be set to a value of 1830; the value of the input network variable **nviIn2** will then be written to Pr **18.30**. Note: Care must be taken when selecting the destination parameter to ensure that the full input value of **nviIn2** can be written correctly.	

Table 7.27 nviIn1

nviIn1	Default: 0
SNVT Type: UNVT_count_inc_32	Optional
Syntax: *Byte3,Byte2,Byte1,Byte0*	Range: -2^{31} to $2^{31}-1$

This input network variable value will be written to the drive parameter specified by the network input variable **nviInDest1**.
The actual value written to the drive parameter is calculated as follows:

For values of *Byte3* less than 128. (positive parameter values from 0 to $2^{31}-1$).
*value = Byte0 + (Byte1 * 256) + (Byte2 * 256^2) + (Byte3 * 256^3).*

For values of *Byte3* greater than 127. (negative parameter values from -2^{31} to -1).
*value = (Byte0 + (Byte1 * 256) + (Byte2 * 256^2) + (Byte3 * 256^3)) - 2^{32}.*

For example, to write the value "123456789" to the drive parameter specified in **nviInDest1**,

Byte0 = 21	21 * 1 = 21
Byte1 = 205	205 * 256 = 52480
Byte2 = 91	91 * 256^2 = 5963776
Byte3 = 7	7 * 256^3 = 117440512

Value = 21 + 52480 + 5963776 + 117440512 = 123456789

Table 7.28 nviIn2

nviIn2	Default: 0
SNVT Type: UNVT_count_inc_32	Optional
Syntax: *Byte3,Byte2,Byte1,Byte0*	Range: -2^{31} to $2^{31}-1$

This input network variable value will be written to the drive parameter specified by the network input variable **nviInDest2**.
The actual value written to the drive parameter is calculated as follows:

For values of *Byte3* less than 128. (positive parameter values from 0 to $2^{31}-1$).
*value = Byte0 + (Byte1 * 256) + (Byte2 * 256^2) + (Byte3 * 256^3).*

For values of *Byte3* greater than 127. (negative parameter values from -2^{31} to -1).
*value = (Byte0 + (Byte1 * 256) + (Byte2 * 256^2) + (Byte3 * 256^3)) - 2^{32}.*

For example, to write the value "123456789" to the drive parameter specified in **nviInDest2**,

Byte0 = 21	21 * 1 = 21
Byte1 = 205	205 * 256 = 52480
Byte2 = 91	91 * 256^2 = 5963776
Byte3 = 7	7 * 256^3 = 117440512

Value = 21 + 52480 + 5963776 + 117440512 = 123456789

Table 7.29 nviOutSrc1

nviOutSrc1	Default: 1811
SNVT Type: SNVT_count	Optional
Syntax: *Value*	Range: 0 to 65535
This input network variable is used to specify a drive parameter to be used as the source for the output network variable **nvoOut1**. The value in this network variable should be the drive menu number multiplied by 100 plus the parameter number; e.g. to use Pr **18.30** as the source parameter, this network variable should be set to a value of 1830; the value of Pr **18.30** will then be written to the network output variable **nvoOut1**.	

Table 7.30 nviOutSrc2

nviOutSrc2	Default: 1812
SNVT Type: SNVT_count	Optional
Syntax: *Value*	Range: 0 to 65535
This input network variable is used to specify a drive parameter to be used as the source for the output network variable **nvoOut2**. The value in this network variable should be the drive menu number multiplied by 100 plus the parameter number; e.g. to use Pr **18.30** as the source parameter, this network variable should be set to a value of 1830; the value of Pr **18.30** will then be written to the network output variable **nvoOut2**.	

Table 7.31 nviSetupDrvPars

nviSetupDrvPars	Default: 0.0, 0
SNVT Type: SNVT_switch	Optional
Syntax: *Value*,*State*	Range: N/A, 0 to 1
This input network variable provides an easy method of configuring the drive reference selectors for use on the LonWorks® network. The first setting (*Value*) will be ignored by SM-LON. The second setting (*State*) is used to configure the reference selectors in the drive; the configuration changes will only be initiated upon a transition from 0 to 1 in the value of *State*. The following drive parameters will be changed: Pr **1.10** = 1 (bipolar reference enable) Pr **1.14** = 3 (select preset reference specified by #1.15) Pr **1.15** = 1 (select preset reference 1 - #1.21) Pr **2.02** = 1 (ramp enable) Pr **2.10** = 9 (acceleration rate selector) Pr **2.20** = 9 (deceleration rate selector) Pr **3.13** = 0 (enable frequency slaving) Pr **4.11** = 0 (torque mode selector - speed control) Pr **6.01** = 1 (stop mode = ramped stop) Pr **6.43** = 1 (control word enable) These changes will then be saved automatically by SM-LON.	

Table 7.32 nviTriggerEvent

nviTriggerEvent	Default: 0.0, 0
SNVT Type: SNVT_switch	Optional
Syntax: *Value,State*	Range: N/A, 0 to 1
This input network variable is used in conjunction with the **nciEventTask** to trigger an event task within a SM-Applications or SM-Applications Lite module. The first setting (*Value*) will be ignored by SM-LON. The second setting (*State*) is used to trigger the SM-Applications or SM-Applications Lite event task; the event task will only be initiated upon a transition from 0 to 1 in the value of *State*.	

7.4.12 VSD Functional Block Control Techniques Specific Output Network Variables

Table 7.33 nvoAnlgInput1

nvoAnlgInput1	Default: N/A
SNVT Type: SNVT_lev_percent	Mandatory
Syntax: *Value*	Range: ±100.000%
This output network variable is mapped to the drive analog input 1 (Pr **7.01**). The resolution of this network variable is identical to Pr **7.01** and accurate to two decimal places.	

Table 7.34 nvoAnlgInput2

nvoAnlgInput2	Default: N/A
SNVT Type: SNVT_lev_percent	Mandatory
Syntax: *Value*	Range: ±100.000%
This output network variable is mapped to the drive analog input 2 (Pr **7.02**). The resolution of this network variable is identical to Pr **7.02** and accurate to one decimal place.	

Table 7.35 nvoAppSpecific1

nvoAppSpecific1	Default: 0
SNVT Type: SNVT_count_inc	Optional
Syntax: *Value*	Range: -32768 to 32767
This output network variable will map directly to Pr **18.16** and provides a means of reading a value from the drive. This network variable is better suited for run-time usage than the configurable parameter output variables **nvoOut1** or **nvoOut2**.	

Table 7.36 nvoAppSpecific2

nvoAppSpecific2	Default: 0
SNVT Type: SNVT_count_inc	Optional
Syntax: *Value*	Range: -32768 to 32767
This output network variable will map directly to Pr **18.17** and provides a means of reading a value from the drive. This network variable is better suited for run-time usage than the configurable parameter output variables **nvoOut1** or **nvoOut2**.	

Table 7.37 nvoAppSpecific3

nvoAppSpecific3	Default: 0
SNVT Type: SNVT_count_inc	Optional
Syntax: *Value*	Range: -32768 to 32767
This output network variable will map directly to Pr **18.17** and provides a means of reading a value from the drive. This network variable is better suited for run-time usage than the configurable parameter output variables **nvoOut1** or **nvoOut2**.	

Table 7.38 nvoDirectionAct

nvoDirectionAct	Default: N/A, N/A
SNVT Type: SNVT_switch	Optional
Syntax: *Value,State*	Range: N/A, 0 to 1
This output network variable is used to indicate the direction in which the motor is running. The first setting (*Value*) is not used by SM-LON. The second setting (*State*) is used to indicate the motor direction, a value of 0 indicates the forward direction and a value of 1 indicates the reverse direction. This value is taken from Pr **10.14**.	

Table 7.39 nvoDrvHealthy

nvoDrvHealthy	Default: N/A, N/A
SNVT Type: SNVT_switch	Optional
Syntax: *Value,State*	Range: N/A, 0 to 1
This output network variable is used to indicate the healthy state of the drive. The first setting (*Value*) is not used by SM-LON. The second setting (*State*) is used to indicate the drive healthy state, a value of 0 indicates the drive is not OK and a value of 1 indicates the drive is OK. This value is taken from Pr **10.01**.	

Table 7.40 nvoDrvRunning

nvoDrvRunning	Default: N/A, N/A
SNVT Type: SNVT_switch	Optional
Syntax: *Value,State*	Range: N/A, 0 to 1
This output network variable is used to indicate if the drive output is active. The first setting (*Value*) is not used by SM-LON. The second setting (*State*) is used to indicate the drive output active state, a value of 0 indicates the drive output is not active and a value of 1 indicates the drive output is active. This value is taken from Pr **10.02**.	

Table 7.41 nvoEmergOvrStat

nvoEmergOvrStat	Default: EMERG_NORMAL
SNVT Type: SNVT_hvac_emerg	Optional
Syntax: *State*	Range: EMERG_NORMAL or EMERG_FIRE
This output network variable is used to indicate if the drive is in fire mode. If SM-LON is installed on a SP HVAC drive, the value of this network variable will be determined by parameters Pr **1.53** (Fire mode reference) and Pr **1.54** (Fire mode active); if Pr **1.53** has a non-zero value and Pr **1.54** is *ON* then the drive is in fire mode and this network variable will be set to EMERG_FIRE, the drive control inputs (Run, speed reference etc.) will be disabled and the drive will run at the emergency preset speed (refer to Affinity User Guide for more information on emergency fire mode). All other conditions will set this network variable to EMERG_NORMAL. If SM-LON is not installed on a SP HVAC drive the value of this network variable will always be EMERG_NORMAL.	

Table 7.42 nvoFreqAct

nvoFreqAct	Default: N/A
SNVT Type: SNVT_freq_hz	Optional
Syntax: *Value*	Range:0 to 3000 Hz
This output network variable indicates the actual drive output frequency. This value is taken from Pr **5.01**.	

Table 7.43 nvoIOState

nvoIOState	Default: N/A
SNVT Type: SNVT_state	Optional
Syntax: *State*	Range: N/A
This output network variable is used to indicate the status of the drive digital I/O terminals. This value is taken from Pr **8.20**.	

Table 7.44 nvoOut1

nvoOut1	Default: N/A
SNVT Type: UNVT_count_inc_32	Optional
Syntax: *Byte3,Byte2,Byte1,Byte0*	Range: -2^{31} to $2^{31}-1$
This output network variable is used to return the value in the drive parameter specified by the output network variable **nviOutSrc1**. The actual value of the drive parameter is calculated as follows: For values of *Byte3* less than 128. (positive parameter values from 0 to $2^{31}-1$). *value = Byte0* + (*Byte1 * 256)* + (*Byte2 * 256^2)* + (*Byte3 * 256^3)*. For values of *Byte3* greater than 127. (negative parameter values from -2^{31} to -1). *value = (Byte0* + (*Byte1 * 256)* + (*Byte2 * 256^2)* + (*Byte3 * 256^3)) - 2^{32}*.	
For example, the value "-123456789" in the drive parameter specified in **nviOutSrc1**, is displayed as *Byte0* = 235 235 * 1 = 235 *Byte1* = 50 50 * 256 = 12800 *Byte2* = 164 164 * 256^2 = 10747904 *Byte3* = 248 248 * 256^3 = 4160749568 Value = (235 + 12800 + 10747904 + 4160749568) - 2^{32} = -123456789	

Table 7.45 nvoOut2

nvoOut2	Default: N/A
SNVT Type: UNVT_count_inc_32	Optional
Syntax: *Byte3,Byte2,Byte1,Byte0*	Range: -2^{31} to $2^{31}-1$
This output network variable is used to return the value in the drive parameter specified by the output network variable **nviOutSrc2**. The actual value of the drive parameter is calculated as follows: For values of *Byte3* less than 128. (positive parameter values from 0 to $2^{31}-1$). *value = Byte0* + (*Byte1 * 256)* + (*Byte2 * 256^2)* + (*Byte3 * 256^3)*. For values of *Byte3* greater than 127. (negative parameter values from -2^{31} to -1). *value = (Byte0* + (*Byte1 * 256)* + (*Byte2 * 256^2)* + (*Byte3 * 256^3)) - 2^{32}*.	
For example, the value "-123456789" in the drive parameter specified in **nviOutSrc2**, is displayed as *Byte0* = 235 235 * 1 = 235 *Byte1* = 50 50 * 256 = 12800 *Byte2* = 164 164 * 256^2 = 10747904 *Byte3* = 248 248 * 256^3 = 4160749568 Value = (235 + 12800 + 10747904 + 4160749568) - 2^{32} = -123456789	

Table 7.46 nvoOverloadWrn

nvoOverloadWrn	Default: N/A, N/A
SNVT Type: SNVT_switch	Optional
Syntax: *Value,State*	Range: N/A, 0 to 1
This output network variable provides two settings, the first setting (*Value*) is not used by SM-LON. The second setting (*State*) is used to indicate a drive overload warning. This value is taken from Pr **10.17**.	

Table 7.47 nvoSpeedActRpm

nvoSpeedActRpm	Default: N/A
SNVT Type: SNVT_rpm	Mandatory
Syntax: *Value*	Range: 0 to 40000 RPM
This output network variable is used to indicate the actual motor speed in RPM. In open loop mode, this value will be calculated from the drive speed output Pr **5.04**. In closed loop modes, this value will be the actual measured speed feedback from Pr **3.02**.	

Table 7.48 nvoTempWrn

nvoTempWrn	Default: N/A, N/A
SNVT Type: SNVT_switch	Optional
Syntax: *Value,State*	Range: N/A, 0 to 1
This output network variable provides two settings, the first setting (*Value*) is not used by SM-LON. The second setting (*State*) is used to indicate a drive over-temperature warning. This value is taken from Pr **10.18**.	

Table 7.49 nvoZeroSpeed

nvoZeroSpeed	Default: N/A, N/A
SNVT Type: SNVT_switch	Optional
Syntax: *Value,State*	Range: N/A, 0 to 1
This output network variable provides two settings, the first setting (*Value*) is not used by SM-LON. The second setting (*State*) is used to indicate if the motor is at zero speed. This value is taken from Pr **10.03**. Note: It may be necessary to set the zero speed threshold (Pr **3.05**) to suit the application.	

7.4.13 VSD Functional Block CT Specific Configuration Property

Table 7.50 nciEventTask

nciEventTask	Default: 0, 0
SNVT Type: UCPTeventTaskSelector	Optional
Syntax: *Slot*,*Event*	Range: 0 to 255, 0 to 255
This input configuration property provides two settings, the first setting (*Slot*) specifies the drive slot number of the SM-Applications or SM-Applications Lite module which contains the event task to be triggered by the network variable **nviTriggerEvent**. The second setting (*Event*) specifies the event task number to be triggered of the SM-Applications or SM-Applications Lite module installed in the slot specified by *Slot*.	
Slot	
Slot = 0	Specifies to use the applications module installed in the lowest available slot position. E.g. If two applications modules are installed in slots 2 and 3 then this will specify to use the module installed in slot 2.
Slot = 1	Specifies the module installed in slot 1.
Slot = 2	Specifies the module installed in slot 2.
Slot = 3	Specifies the module installed in slot 3.
Event	
Event = 0	Specifies to use the **`Event`** task of the applications module installed in the slot position specified by *Slot*.
Event = 1	Specifies to use the **`Event1`** task of the applications module installed in the slot position specified by *Slot*.
Event = 2	Specifies to use the **`Event2`** task of the applications module installed in the slot position specified by *Slot*.
Event = 3	Specifies to use the **`Event3`** task of the applications module installed in the slot position specified by *Slot*.
Note: If an SM-Applications module is not installed in the specified slot position then no event task will be triggered.	

NOTE The Commander SK drive does not support more than one option module installed, consequently, if using SM-LON the **nciEventTask** and **nviTriggerEvent** network variables cannot be used with the Commander SK drive.

8 Diagnostics

This section of the manual provides basic diagnostic information intended to enable resolution of the most common problems encountered when setting up a SM-LON module.

A high percentage of problems reported are basic setup problems that can be avoided by using the following pages. Start by using the *Diagnostic flow chart* on page 57 to determine the possible cause of a problem. If after following the flow chart you are still experiencing problems please contact your supplier or local drive centre for support.

NOTE Please note that support will be limited to setup and networking of the drive and not network infrastructure design.

8.1 LED diagnostics

The SM-LON module is equipped with 2 diagnostics LEDs on the front panel as illustrated in Figure 8-1. The functions of these LEDs are described in Table 8.1.

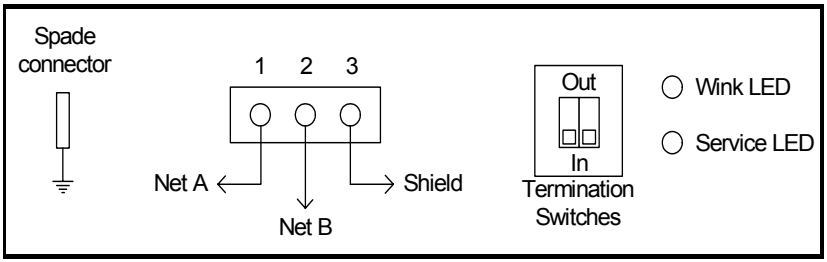
Table 8.1 LED functionality

LED Name	LED State	Description
Wink	Off	Normal.
	Flashing green	Wink function active.
Service	Off	Normal.
	Flashing red slow (1 second on, 1 second off)	Device not configured on the network.

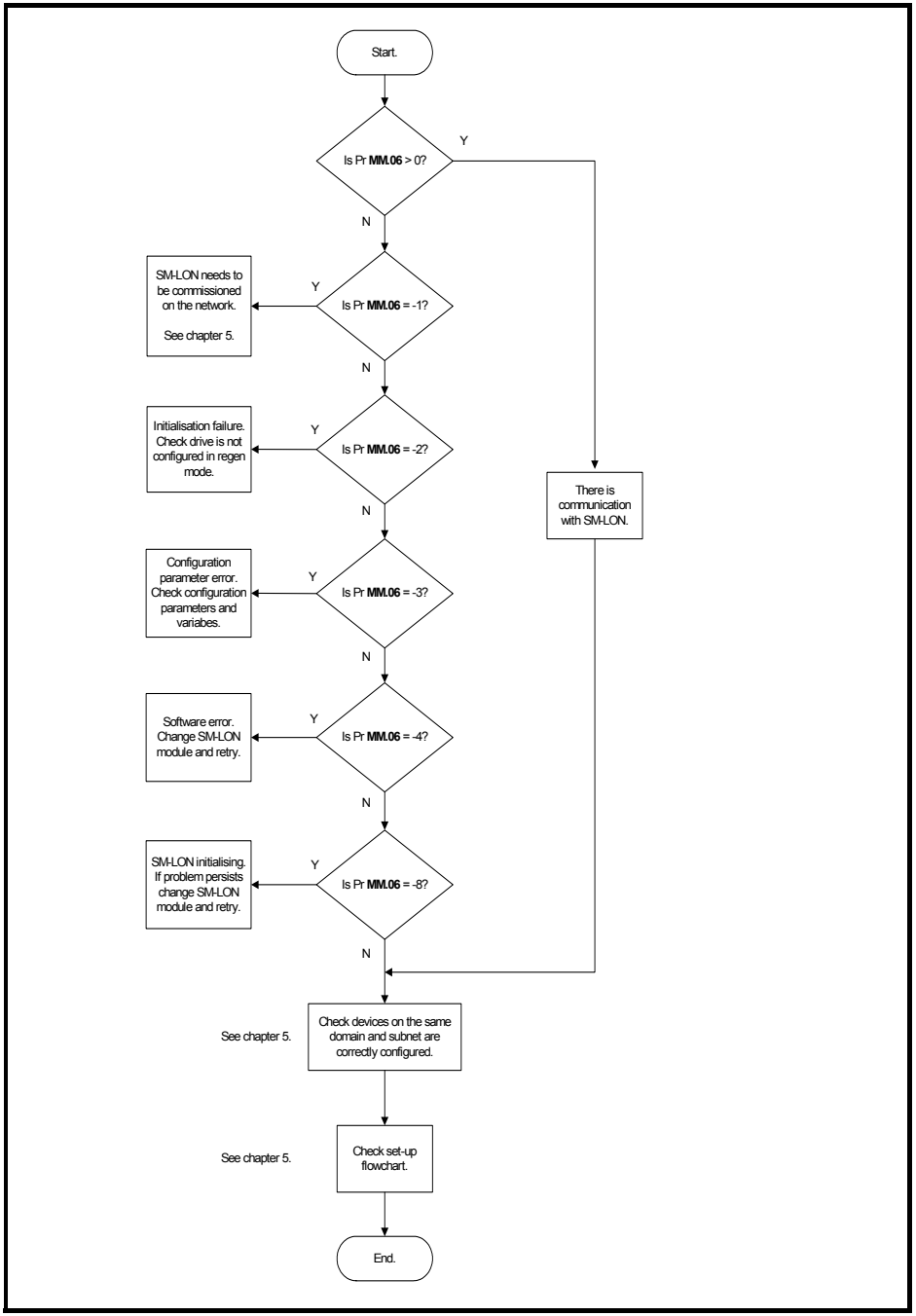
The *Wink* LED is used to check that network communication is possible to SM-LON; for more information on the 'wink' function, see section 6.21 *SM-LON wink* on page 34.

The *Service* LED is used to indicate whether or not the SM-LON module is commissioned on the network; for more information on configuring SM-LON see section 5.3 *Setting up the SM-LON module* on page 17.

Figure 8-1 SM-LON module connections and indications



8.2 Diagnostic flow chart


Start.
Is Pr MM.06 > 0?
Y
N
SM-LON needs to be commissioned on the network.
See chapter 5.
Is Pr MM.06 = -1?
Initialisation failure. Check drive is not configured in regen mode.
Is Pr MM.06 = -2?
There is communication with SM-LON.
Configuration parameter error. Check configuration parameters and variabes.
Is Pr MM.06 = -3?
Software error. Change SM-LON module and retry.
Is Pr MM.06 = -4?
SM-LON initialising. If problem persists change SM-LON module and retry.
Is Pr MM.06 = -8?
See chapter 5.
Check devices on the same domain and subnet are correctly configured.
See chapter 5.
Check set-up flowchart.
End.

8.3 Module identification parameters

The basic menu parameters can be accessed through the slot menu in the drive, Pr **MM.xx** where **MM** is the menu for SM-LON in the host drive. The basic menu parameters may also be accessed using menu 60, i.e. Pr **60.xx**.

8.3.1 SM-LON module ID code

SM-LON - module ID code		
Pr **MM.01**	**Default**	401 (SM-LON)
	Range	-
	Access	RO

The module ID code indicates the type of module installed in the slot corresponding to menu **MM**. This is useful for checking the module is of the correct type. The ID code for SM-LON is 401.

8.3.2 SM-LON firmware version

SM-LON firmware - major version (mm.mm)		
Pr **MM.02**	**Default**	N/A
	Range	00.00 to 99.99
	Access	RO

SM-LON firmware - minor version (nn)		
Pr **MM.51**	**Default**	N/A
	Range	0 to 99
	Access	RO

The full version of the SM-LON firmware can be read from the two parameters above. The full version is assembled by combining the major version (mm.mm) and the minor version (nn) as follows: mm.mm.nn.

8.4 Network configuration parameters

8.4.1 SM-LON node ID

SM-LON node ID		
Pr **MM.03**	**Default**	0
	Range	0 to 127
	Access	RO

This is used as a way to identify the node on the network. This parameter is an indication of the value set by the network configuration tool during commissioning, it is not used to actually set the node ID of the drive and can only be changed during the network commissioning process

8.4.2 SM-LON network loss trip

SM-LON network loss trip		
Pr **MM.07**	**Default**	0
	Range	0 to 1
	Access	RW

This parameter is used (in conjunction with the received heartbeat time configuration variable - *nciRcvHrtBt*) to cause a trip condition if the network is lost. The value of the variable *nciRcvHrtBt* determines the approximate time (in Seconds) that SM-LON will wait, after not receiving any network information, before forcing a network loss trip (Pr **MM.50**=65).

NOTE For a network loss trip to occur, Pr **MM.07** must be set to 1 and the network variable *nciRcvHrtBt* must be set to a value greater than zero.

NOTE Before the network loss trip is initiated, the motor will be stopped using the speed control configuration properties so the overall trip time may be greater than the setting of the *nciRcvHrtBt* configuration property.

8.4.3 SM-LON subnet ID

SM-LON subnet ID		
Pr **MM.10**	**Default**	0
	Range	0-255
	Access	RO

This is used as a way to identify the subnet on the network. This parameter is an indication of the value set by the network configuration tool during commissioning, it is not used to actually set the subnet ID value and can only be changed during the network commissioning process.

8.4.4 SM-LON domain ID length

SM-LON domain ID length		
Pr **MM.11**	**Default**	0
	Range	0-6
	Access	RO

This is used to indicate the number of bytes within the LonWorks® message which constitute the domain ID number and can only be changed during the network commissioning process.

8.4.5 SM-LON domain ID

SM-LON domain ID		
	Default	0
	Range	0-255
	Access	RO
Pr **MM.12**	Byte 1	
Pr **MM.13**	Byte 2	
Pr **MM.14**	Byte 3	
Pr **MM.15**	Byte 4	
Pr **MM.16**	Byte 5	
Pr **MM.17**	Byte 6	

The domain ID byte parameters are used to indicate the network domain ID number to which SM-LON is connected. These domain parameters indicate the value set by the network configuration tool during commissioning, they are not used to actually set the domain ID value and can only be changed during the network commissioning process.

8.5 Diagnostic parameters

8.5.1 SM-LON diagnostic information

Diagnostic Information		
Pr **MM.06**	**Default**	N/A
	Range	-9999 to 9999
	Access	RO

The diagnostic information for the SM-LON can be viewed in the diagnostic information parameter (Pr **MM.06**). When the SM-LON is communicating successfully, Pr **MM.06** will give an indication of the number of network variable updates per second. This includes received messages from other devices and transmitted messages from SM-LON. These messages will generally be network variable updates.

If the SM-LON module cannot be detected on the network by the network configuration tool or other devices on the same domain, then the value in this parameter can be used to assist in diagnosing the cause of the problem. Table 8.2 *SM-LON operating status codes* lists the possible values for this parameter.

Table 8.2 SM-LON operating status codes

Pr MM.06	Description
	Running states
>0	Indicates the total number of messages SM-LON has detected per second.
0	Module commissioned, but no network messages detected.
-1	The Solutions Module has initialised correctly but has not been commissioned on the network.
-2	Initialisation failure, one possible cause of initialisation failure is the drive is configured in regen mode.
-3	Invalid configuration parameters.
-4	Software error.
-8	The drive interface is being initialised.

If the SM-LON module does not initialise correctly when the drive is powered up, remove the power from the drive, wait for the under-voltage ('UU') trip to disappear and re-apply the power, if the problem persists then the SM-LON module should be changed.

8.5.2 SM-LON option module error status

SM-LON option module error status		
Pr **MM.50**	**Default**	0
	Range	0 to 255
	Access	R

If an error occurs the reason for the error is written to this parameter and the drive may produce a slot error. A value of 0 indicates that the module has not detected an error. For a list of SM-LON error codes see Table 8.3.

NOTE This parameter is reset to 0 if SM-LON is reset.

Table 8.3 SM-LON error codes

Pr MM.50	Error Description
0	No fault present.
58	Incorrect non-volatile storage. At least one configuration property was incorrectly formatted or corrupt. Configuration property default values were loaded.
61	Invalid configuration parameters. This trip will occur if the SM-LON option is installed in a Unidrive SP configured in regen mode.
65	Network loss. See section 6.5 *SM-LON network loss trip* on page 29.
70	No valid fieldbus menu data available in the module to download to the drive. The user may not have saved any data or the data save may not have completed successfully.
74	The option module has overheated.
99	Software fault.

9 Quick Reference

9.1 Complete parameter reference

The table below lists all the SM-LON set-up parameters that are required to configure the module.

Table 9.1 SM-LON parameter reference

Parameter	Default	Cross reference	
Pr **MM.01**	401	Section 6.1 on page 28	Module ID code (SM-LON 401)
Pr **MM.02**	-	Section 6.2 on page 28	Option module firmware version
Pr **MM.03**	0	Section 6.3 on page 28	Node ID
Pr **MM.06**	0	Section 6.4 on page 29	Option module diagnostic information
Pr **MM.07**	0	Section 6.5 on page 29	Network loss trip
Pr **MM.10**	0	Section 6.6 on page 30	Subnet ID
Pr **MM.11**	0	Section 6.7 on page 30	Domain ID length
Pr **MM.12**	0	Section 6.8 on page 30	Domain ID byte 1
Pr **MM.13**	0	Section 6.9 on page 30	Domain ID byte 2
Pr **MM.14**	0	Section 6.11 on page 31	Domain ID byte 3
Pr **MM.15**	0	Section 6.11 on page 31	Domain ID byte 4
Pr **MM.16**	0	Section 6.12 on page 31	Domain ID byte 5
Pr **MM.17**	0	Section 6.13 on page 31	Domain ID byte 6
Pr **MM.30**	OFF	Section 6.14 on page 31	Load option defaults
Pr **MM.31**	OFF	Section 6.15 on page 32	Save option parameters
Pr **MM.32**	OFF	Section 6.16 on page 32	Request to re-initialise
Pr **MM.33**	OFF	Section 6.17 on page 33	Restore parameters from option module
Pr **MM.34**	OFF	Section 6.18 on page 33	Initialise drive reference selectors
Pr **MM.35**	-	Section 6.19 on page 33	Option module serial number
Pr **MM.36**	OFF	Section 6.20 on page 34	Transmit service pin message
Pr **MM.37**	OFF	Section 6.21 on page 34	Wink active
Pr **MM.38**	0	Section 6.22 on page 34	Unconfigure option module
Pr **MM.39**	0	Section 6.23 on page 35	Default configuration property storage
Pr **MM.50**	0	Section 6.24 on page 35	Option module error status
Pr **MM.51**	-	Section 6.2 on page 28	Option module firmware sub-version

9.2 Complete network variables reference

Table 9.2 lists the network variables supported by the SM-LON module.

Table 9.2 Network variables reference

Variable name	Cross reference	Type	Mandatory	Object	Mode
Standard Network Variables					
nviRequest	Table 7.1 on page 38	SNVT	Yes	Node	Input
nvoStatus	Table 7.2 on page 39	SNVT	Yes	Node	Output
nvoAlarm2	Table 7.3 on page 40	SNVT	No	Node	Output
nciLocation	Table 7.4 on page 41	SCPT	No	Node	Input
nviDrvSpeedScale	Table 7.5 on page 44	SNVT	No	VSD	Input
nviDrvSpeedStPt	Table 7.6 on page 44	SNVT	Yes	VSD	Input
nvoDrvCurnt	Table 7.7 on page 44	SNVT	No	VSD	Output
nvoDrvPwr	Table 7.8 on page 45	SNVT	No	VSD	Output
nvoDrvRunHours	Table 7.9 on page 45	SNVT	No	VSD	Output
nvoDrvSpeed	Table 7.10 on page 45	SNVT	Yes	VSD	Output
nvoDrvVolt	Table 7.11 on page 45	SNVT	No	VSD	Output
nciDrvSpeedScale	Table 7.12 on page 45	SCPT	No	VSD	Input
nciMaxSpeed	Table 7.13 on page 46	SCPT	Yes	VSD	Input
nciMinSpeed	Table 7.14 on page 46	SCPT	Yes	VSD	Input
nciNmlFreq	Table 7.15 on page 46	SCPT	Yes	VSD	Input
nciNmlSpeed	Table 7.16 on page 46	SCPT	Yes	VSD	Input
nciRampDownTime	Table 7.17 on page 46	SCPT	Yes	VSD	Input
nciRampUpTime	Table 7.18 on page 46	SCPT	Yes	VSD	Input
nciRcvHrtBt	Table 7.19 on page 47	SCPT	No	VSD	Input
nciSndHrtBt	Table 7.20 on page 47	SCPT	Yes	VSD	Input
Control Techniques Specific Network Variables					
nviAppSpecific1	Table 7.21 on page 47	SNVT	No	VSD	Input
nviAppSpecific2	Table 7.22 on page 47	SNVT	No	VSD	Input
nviAppSpecific3	Table 7.23 on page 48	SNVT	No	VSD	Input
nviDrvReset	Table 7.24 on page 48	SNVT	No	VSD	Input
nviInDest1	Table 7.25 on page 48	SNVT	No	VSD	Input
nviInDest2	Table 7.26 on page 48	SNVT	No	VSD	Input
nviIn1	Table 7.27 on page 49	UNVT	No	VSD	Input
nviIn2	Table 7.28 on page 49	UNVT	No	VSD	Input
nviOutSrc1	Table 7.29 on page 50	SNVT	No	VSD	Input
nviOutSrc2	Table 7.30 on page 50	SNVT	No	VSD	Input
nviSetupDrvPars	Table 7.31 on page 50	SNVT	No	VSD	Input
nviTriggerEvent	Table 7.32 on page 50	SNVT	No	VSD	Input
nvoAnlgInput1	Table 7.33 on page 51	SNVT	No	VSD	Output
nvoAnlgInput2	Table 7.34 on page 51	SNVT	No	VSD	Output
nvoAppSpecific1	Table 7.35 on page 51	SNVT	No	VSD	Output
nvoAppSpecific2	Table 7.36 on page 51	SNVT	No	VSD	Output
nvoAppSpecific3	Table 7.37 on page 51	SNVT	No	VSD	Output
nvoDirectionAct	Table 7.38 on page 52	SNVT	No	VSD	Output
nvoDrvHealthy	Table 7.39 on page 52	SNVT	No	VSD	Output
nvoDrvRunning	Table 7.40 on page 52	SNVT	No	VSD	Output

Table 9.2 Network variables reference

Variable name	Cross reference	Type	Mandatory	Object	Mode
nvoEmergOvrStat	Table 7.41 on page 52	SNVT	No	VSD	Output
nvoFreqAct	Table 7.42 on page 52	SNVT	No	VSD	Output
nvoIOState	Table 7.43 on page 53	SNVT	No	VSD	Output
nvoOut1	Table 7.44 on page 53	SNVT	No	VSD	Output
nvoOut2	Table 7.45 on page 53	SNVT	No	VSD	Output
nvoOverloadWrn	Table 7.46 on page 54	SNVT	No	VSD	Output
nvoSpeedActRpm	Table 7.47 on page 54	SNVT	No	VSD	Output
nvoTempWrn	Table 7.48 on page 54	SNVT	No	VSD	Output
nvoZeroSpeed	Table 7.49 on page 54	SNVT	No	VSD	Output
nciEventTask	Table 7.50 on page 55	UCPT	No	VSD	Input

10 Glossary Of Terms

Address: This is the unique network identification given to a networked device to allow communication on a network. When a device sends or receives data the address is used to determine the source and the destination of the message.

Bit: A binary digit, this may have the value of 1 or 0.

Byte: A collection of 8 binary digits that collectively store a value. This may be signed or unsigned.

Configuration properties: User-configurable values which define the behaviour of a device.

Control word: A collection of binary digits that are used to control the drive. Features typically include directional controls, run controls and other similar functions.

Cyclic (implicit or polled) data: Data that is transmitted at regular intervals over the network. Sometimes referred to as “Implicit data” or “Polled data”.

Data rate: Determines the communication speed of the network, the higher the value the more data can be sent across the network in the same time period.

Device: A piece of equipment connected to a network, this may be any type of equipment including repeaters, hubs, masters or slaves.

DIP switch: An electronic switch packaged as a group of switches in a standard dual in-line package.

Domain: A group of devices connected together on a network and addressed using the same identifier that can communicate with other.

Double word: A 32 bit word, this may be signed or unsigned.

Earthing / Grounding: Describes the electrical safety or shielding connections for the module.

Explicit data: *See **Non-cyclic data**.*

Functional Block: A collection of the functionalities available on a particular LonWorks® device. Each functional block contains a series of variables used as network data links (***Network variables***) and another series of variables used to configure the device (***Configuration properties***).

Implicit data: *See **Cyclic data**.*

LED: Light emmiting diode.

Long word: A 32 bit data word that may be signed or unsigned.

LSB: Least significant bit/byte.

MSB: Most significant bit/byte.

Network variables: Objects within the functional block which provide the mechanism for devices to send and receive data over the network.

Neuron ID: The 48 bit serial number of the LonWorks® transceiver IC.

Node: A device on the network. This may be either a device such as a drive or part of the network such as a repeater.

Node object: A functional block object which provides basic device management features.

Non-cyclic (explicit) data: Data that is requested or sent as required and not on a regular basis. Sometimes referred to as “Explicit data”.

Octet: A collection of 8 binary digits which form a byte.

PC: Personal computer.

PLC: Programmable logic controller.

Poll rate: The rate at which cyclic data is sent and received on the network.

Polled data: *See **Cyclic data**.*

Scan rate: See ***Poll rate***.

Shielding: A connection to provide additional immunity to noise used on a network cable.

Status word: A value that denotes the status of the drive. Each bit within the word will have a specific meaning.

Subnet: A part of a network that identifies a range of devices connected together. Devices on the same subnet may communicate directly with other devices on the same subnet without the use of a gateway.

Terminating resistor: A resistor connected to network data wires in order to suppress reflected signals.

VSD: An acronym for **V**ariable **S**peed motor **D**rive, a functional block which provides basic drive control.

Word: A collection of 16 binary digits.

XIF file: An acronym for e**X**ternal **I**nterface **F**ile - a file which specifies the device configuration properties.

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